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# SURGERY, GYNECOLOGY AND OBSTETRICS

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NUMBER 1

## INTERPLEURAL PNEUMOLYSIS

### AN OPERATIVE PROCEDURE IN PULMONARY TUBERCULOSIS

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IT seems to be generally acknowledged that the pneumothorax treatment of tuberculosis of the lungs according to the methods of Forlanini and Murphy is of value in combating that disease inasmuch as in suitable cases it meets the indication of giving the diseased organ more or less functional rest of permitting the fibrous tissue to contract about tuberculous foci encapsulating them and of causing lung cavities to collapse, discharge their contents, and in some cases to become obliterated. The pneumothorax treatment will not bring about these results under all circumstances, but only as I stated, in suitable cases their accomplishment depends upon the degree of collapse of the lung which the introduction of gas into the pleural cavity is capable of establishing. Now it is well known that in many cases of pulmonary tuberculosis the adhesions are so extensive that the pleural cavity is practically if not completely obliterated. In such cases it is plainly impossible to inject the nitrogen. In other cases, where only a limited portion of the pleural cavity is free from adhesions, the collapse of the lung produced by the injection of nitrogen will be too slight to be of much, if any value. In many cases in which the pneumothorax treat-

ment had been established the X-ray pictures revealed the fact that, while the lower part of the lung collapsed to a slight or fair degree, the upper portion remained entirely uninfluenced. The expected obliteration of cavities in the upper part through collapse of the lungs therefore, could not ensue or only to a limited degree.

In these cases the operation of extensive removal of the ribs on the affected side from the first or second to the tenth or eleventh, according to Friedrich and others, has been practiced the object being to cause the entire chest wall to collapse with the lung. The desired effect the collapse of the lung, is accomplished by this operation but unfortunately the tuberculous patients whose lungs are so extensively adherent as to render the injection of nitrogen infeasible are apt to be in so weak a condition that they are hardly able to stand the extensive operation of practically depriving half of the chest of its bony frame. As a matter of fact the death rate is rather high, though the chances are better if the operation is done in two stages as recommended by Sanerbruch. The deaths after this operation occur either primarily as a result of shock, owing to the magnitude of the operation, or secondarily as a result of instability of the

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mediastinum (mediastinal fluttering) owing to the lack of support on that side of the chest from which the ribs were removed. The respiratory oxygenation of the blood is deficient as the mediastinum is drawn to the unoperated side on inspiration and forced toward the operated side on expiration. In consequence the lung on the unoperated side is neither satisfactorily expanded on inspiration nor properly emptied on expiration. The lack of support on one side of the chest is also responsible for a certain amount of to-and-fro breathing between the two lungs, the expired air from the better lung being to some extent forced into the collapsed lung and breathed back again on inspiration. Of course the air thus passing from lung to lung does not become oxygenated. Tight strapping of the operated side overcomes these difficulties to some extent.

In view of these facts the problem presented itself to me whether the collapse of the diseased lung could be accomplished by an operation which would not only be simpler than that referred to above but would also preserve the bony frame of the chest. The solution of this problem appeared to me to be found in the intrathoracic separation of the adhesion between the visceral and the parietal pleura. Interpleural pneumolysis, as I have called it — from *lysis* a loosening which in accordance with Greek usage is changed to *lysis* when compounded with another word not a preposition. The modifier interpleural is employed to distinguish the method from that of separating the parietal pleura from the chest wall. Tussier for instance in resecting the apex separates that portion of the parietal pleura which covers the apex from the chest wall, but leaves the parietal pleura attached to the visceral pleura. Baer liberates the costal pleura over the apex in a similar manner without however resecting the apex.

The method of operating is as follows. An incision is conducted by intrathoracic cannulation or other methods of differential pressure to guard against the possible occurrence of respiratory accidents. An incision of ample dimension, about six inches, is made in the sixth or seventh intercostal space at the

posterolateral aspect of the chest down to the pleura, and after all hæmorrhage has been stopped the pleura is opened. The patient now placed with the head low so that if the course of the manipulation of the lung contents of a cavity are expressed they may run into the mouth and not into the opposite lung. The adhesions between the two layers of pleura are then separated. This is accomplished by introducing at first only the tip of a finger to separate the adhesions in the immediate vicinity of the incision, the rib being held apart by retractors. The separation then proceeds further and further until finally the whole hand is introduced into the chest in order to liberate the more distant parts of the lung. In the course of this procedure bands of adhesion may be encountered that are so dense as to require division with the aid of scissors. When the separation of adhesions has been completed the lung will collapse as much as the degree of its infiltration will permit. It is allowed to remain in this state of collapse and is not inflated before closing the thorax. The pleural cavity is closed without drainage. The two ribs which had been spread apart are brought in apposition by paracostal sutures of silk or chromic catgut the muscles are sutured with catgut and the skin with silk worm gut.

Following this operation there is none of the pain that is often experienced in the ordinary pneumothorax treatment after the injection of nitrogen, a pain that is doubtless due to the fact that the injected gas causes sufficient pressure on the lung to stretch some of the adhesions. After the operation no tugging on the pleura can take place although the collapse of the lung is extreme and this circumstance explains the absence of pain.

Subsequent treatment is similar to that given in the ordinary pneumothorax method. Physical examination especially with the aid of the X-ray must determine what extent reabsorption of the air has taken place and whether it is time to make an injection of nitrogen.

Mention must be made of an accident that may occur in the course of the operation. If a cavity in the lung extends as far as the pleura, the wall of this cavity may be injured during



Fig. 1. Pulmonary tuberculosis. External dissection of left lung and removal of upper and middle lobes of right lung. A large cavity in the left lung near its root. The adhesions in the left pleura have drawn the heart, trachea, and bronchial tree off the left



Fig. 2. Five days after operation. Left lung completely collapsed. Left pleura filled with air. The mediastinal organs are now markedly displaced to the right. The lung cavity is no longer to be seen. Note the subcutaneous emphysema at the margins of the picture.

the process of separating adhesions. In that case the inspired air will gain access to the pleural cavity through the lung. If then, owing to a valve like action of the tear in the wall of the lung cavity, this air is prevented from returning through the bronchus as easily as it entered, the pleural cavity will continue to fill with air until the intrapleural pressure forces it out between the two ribs that had been separated. In consequence a subcutaneous emphysema will result, the closure of the skin a rule preventing the air from passing out. The probability also exists that the pleura will be infected from the lung cavity.

It is evident therefore that one should aim to avoid this accident by proceeding with particular caution when separating the adhesions over the lung cavity, the site of which has been accurately localized in advance. In a case like that represented in Fig. 1, where the cavity is situated rather close to the median line, one might very well consider leaving the adhesions over it undisturbed, as their presence would not prevent the lung from sinking in toward the mediastinum. If one has reason to believe that a perforation of the wall of a cavity has taken place, the site of the lesion

should be determined with the aid of artificial inflation of the lung and the wound repaired by inverting the torn edge and inserting sero-serous sutures. For the purpose of applying the stitches the lung should be made to collapse again.

In the case described below an injury to a large cavity did occur and extensive subcutaneous emphysema promptly set in, but at first no infection of the pleura resulted, the patient's temperature after the end of the first week ranging between 99 and 100 although for many weeks previous to the operation it had been as high as 102 or 103 in the evening with morning remissions. Later however an infection manifested itself. The main points of the history are as follows:

Mrs. K. W., 30 years old, had been coughing for a long time, more so in the last two months than previously. For five weeks she has had daily chills followed by fever. She is very weak, very anemic and poorly nourished. Chest expansion poor, especially on the left side. Over the entire left lung subcrepant rales are heard both on inspiration and on expiration.

Seven weeks after her admission to the hospital she was brought under my observation with the request that the pneumothorax treatment be given.

On examination I became convinced that the left lung was adherent to such an extent as to render that treatment impossible. I also found the evidence of

large cavity in its upper part. A pair of stereoscopic X-ray plates taken by Dr. William H. Stewart, one of which is reproduced in Fig. 1, revealed an extensive, but berrulous process in the left lung. Between the fourth and sixth intercostal spaces, near the root, a large cavity partly filled with material is seen. Marked and extensive pleuritic adhesions are present, drawing the heart well over to the left and producing a certain amount of scoliosis. These adhesions are also displacing the trachea and the bronchial tree well to the left. The left bronchus can be distinctly seen to be in direct communication with the large cavity. There is also involvement of the upper and middle lobes of the right lung.

The operation above described was performed Jan. 26, 1913, under intratracheal insufflation anesthesia. The lung did not collapse on opening the pleura, owing to dense adhesions all over the lung attaching it to the parietal pleura. They were firmest at the apex, requiring the use of scissors at one place to liberate the lung. The collapse of the lung was not complete owing to the infiltration of the organ, which was most marked in the upper lobe. The surface of the lung was tickled throughout with tubercles of greater or less size. On opening the pleural cavity previous to closing it some broken down tuberculous material was seen on the gauze mop, an evidence that the cavity in the lung had been injured. The thorax was closed about drainage.

Soon after the completion of the operation subcutaneous emphysema developed which spread rapidly over the trunk and after some time also involved the left side of the face. On the following day it extended over the whole face. The explanation of this occurrence is evident. Inasmuch as the injured lung cavity, as in direct communication with the bronchus the inspired air easily gained access to the pleural cavity but owing to the obliteration of the lacinated tissues, could not readily return the same way.

The emphysema began to subside on the fourth day and was no longer visible at the end of two weeks, though the crackling of the air could still be felt. On the second and third day after operation the patient coughed frequently but subsequently very little, the cough being completely absent for several days in succession. On the first four days unusual marked dyspnoea was noted, this subsided later on and finally disappeared. The temperature rose at first then declined, and at the end of the first week fluctuated between 99 and 100. An X-ray picture (Fig. 2) taken nine days after the operation reveals complete collapse of the left lung, the pleural cavity being filled with air. The mediastinal contents including the heart are now markedly displaced to the right. The cavity in the lung can no longer be seen. On comparing the two plates the first impression is as if the second plate

had been reversed, as the right half of the thorax which harbored the better lung, now presents the hazier picture while the more diseased left side on account of the pneumothorax, is of course perfectly clear. The displacement of the mediastinal organs still further heightens the illusion. At the margin of the picture a very interesting representation of the subcutaneous emphysema is seen. Toward the end of the second week the temperature rose again and in the course of the third week the presence of discharge gave evidence that an infection had taken place. After this had been satisfactorily evacuated the temperature dropped again. The patient's chances now seemed favorable, but in the beginning of the fifth week a profuse and intractable diarrhoea set in which weakened the patient to such an extent that she succumbed within a few days after its onset.

Now what deductions can we draw from this case. Although from the very start a cure could not possibly be expected in this case on account of the advanced disease of the opposite lung, yet some conclusions of importance can safely be accepted. In the first place, the operation itself was well borne by the very weak patient, who was declared by the visiting physician of the hospital, Dr. Richard Stein, to be an absolutely hopeless case near death. Secondly there was the marked diminution of the cough after the third day. Thirdly the drop of the temperature to practically a normal range in the second week and fourthly the disappearance of the cavity in the X-ray picture—not to speak of the subjective improvement. Finally the operation is easy of performance, the only point of importance in the technique being to aoid infusing a cavity. Had I been warned of the possibility of this accident occurring, I would surely have taken a little more time in separating the adhesions but inexperienced as I was, I imagined that utmost speed in performing the operation was the matter of prime importance.

The operation of Interpleural pneumolysis, in my opinion, is to be considered in cases of pulmonary tuberculosis in which the ordinary pneumothorax treatment would be indicated—in which, however, the extent of the adhesions is so great that it either cannot be executed at all or would bring about but an imperfect collapse of the lung. In cases of bronchiectasis, it appears to me, a similar indication would hold good.

STUDIES ON THE FUNCTION OF THE PERIOSTEUM<sup>1</sup>

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AND  
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**I**n 1739 the French naturalist, Duhamel, advanced the idea that bone grew from periosteum like an exogenous stem rises from the inner layer of the bark. However the surgical profession and the pathologists did not generally pay attention to this subject for a good many years. For illustration we refer to the following author: Baillie (1795) in *Morbid Anatomy* makes no reference to the periosteum. Notwithstanding the fact that Cooper wrote concerning the open treatment of fractures there is no mention of the periosteum in Cooper's *Surgery* (1819). Williams' *Principles of Pathology* deals very vaguely with ossification. In *Principles of Surgery* by James Miller (1845) osteitis and periostitis are described. With the advent of the school of pathologists instituted by Dupuytren and Cruveilhier interest was at once awakened in the periosteum. These observers attributed to the periosteum osteogenic qualities and Virchow in 1858 in his work on cellular pathology affirms that bone-cells arise by a process of metaplasia from the periosteum. This view was reinforced by Gegenbaur and it was not until Senn's time that this teaching began to be disputed. Senn taught that provisional callus was the product of the periosteum and that permanent callus was from medullary bone. Macewen in 1887 demonstrated that bone regeneration could take place in human fractures without the aid of periosteum. In 1885 Pilcher reviewed Truheart's attempt to graft the periosteum in a defect of the clavicle. Macnamara (1887) speaks of bone grafting by the periosteum. However the results of the latter rather conclusively show that the periosteum was not the im-

mediate author of actual new bone. The more recent principles laid down by Macewen clear the atmosphere although these are somewhat obscured by the conclusions of Haas and the experiments of Schepelmann. Albee's work does not vitiate Macewen's principles in that in his work periosteal new bone apparently was produced by the periosteum furnishing a rallying point for the stimulated osteoblasts in irritated bone. From Oller's work in 1860 and from the work of Barth one concludes the periosteum not to be a material factor in the regeneration of bone grafts. Murphy corroborated these findings. Carrel, by means of *in vitro* cultivations of sound periosteum with a resulting product of bone-cells does not show that periosteum produces bone as he has not proven that bone-cells were not included in his periosteal grafts.

It is a reasonable law in biology that all tissues are developed from cells of the same tissue. If as has been commonly believed periosteum produces bone cells, it must be an exception to this general law because it is a connective tissue membrane and in accordance with this law can only produce like connective tissue cells and not highly differentiated connective tissue such as bone.

The diversity of opinion expressed by various observers is probably due to the fact that the function of the periosteum in adult bone is slightly different from that of young bone and vastly different from that of irritated bone. From the work of Macewen, we know that in normal adult bone the periosteum is a limiting membrane. In growing bone it furnishes a potential space for peripheral bone. In hyperemic or irritated bone it serves as a refuge for the osteoblast and gives sufficient framework for new bone.

As to the relation between cartilage and

periosteum we have the following apparently paradoxical conditions:

New diaphyseal bone develops in cartilage.

Subperiosteal bone apparently develops without cartilage in a growing bone.

In drill-hole fractures, in which the periosteum may be ignored there is practically no cartilage.

In complete fractures involving the periosteum cartilage is present.

Bones deprived of periosteum and then completely fractured heal without cartilage.

Free periosteum does not produce cartilage.

Therefore Macewen's principles laid down for osteoblast hold good in cartilage-cells.

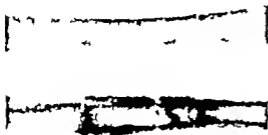


Fig. 11. Normal (left) and (right) After operation. In both the nutrient artery is cut, the bone is irritated and an absorption of osseous tissue resulted. Taken day after operation.

From a very early period various important functions have been attributed to the periosteum which did not properly belong to it. One by one these functions have been removed until now we are trying to take from it the last and most important rôle attributed to it that of bone producing power and to reduce it to the humble position of a protecting membrane. Up to within a very few years osteomyelitis was spoken of as periosteitis and now we know that the periosteum plays a comparatively insignificant part in this important disease. It was once believed that when a bone was stripped of its periosteum necrosis would surely follow. It is

now known that a bone may be stripped of its periosteum and so long as its other sources of blood supply are unimpaired necrosis does not follow.

The late Stephen Smith advocated at one time the formation of perosteal flaps in amputation of the extremities. We soon learned that when this flap was made, the tendency was to the formation of a conical stump and the results were not satisfactory. In the light of our present knowledge, the conical end of the bone was formed in the presence of the periosteum not because the periosteum produced bone but because it confined the osteoblasts to a limited space.



Fig. 12. Subperiosteal border from Maximal L. cavity of Maxilla.

When the periosteum is not placed over the end of the bone it heals very smoothly without excess of bone formation because the excess of the osteoblast have disappeared in the tissue.

The late Professor Sayre insisted very strenuously that in excision of the hip the periosteum should be preserved.

By subperiosteal repair we mean the formation of an involucrum beneath the periosteum. This is a common occurrence in osteomyelitis but in a modified form may occur as a result of irritation without actual infection. In relation to osteomyelitis, there are references to subperiosteal repair occurring in the early literature. Celsus speaks of

hastening repair in some cases of ununited fractures by irritating the ends of the bone. Physick advocated the use of setons. These are only indirect references, and are not intended to convey the idea that the authors understood the immediate result of their procedures. The army records of the Civil War abound with numerous examples of subperiosteal repair of which we show one example. Equally striking examples are found in the University of Minnesota Surgical Museum of which we show two examples. These specimens were partially the result of infection.

More recently J. B. Murphy has called our attention to the occurrence of subperiosteal

Therefore, we will detail these experiments. These are not shown for their immediate surgical value, but rather to emphasize certain principles. Various substances were used—wooden tubes, sponge horn of various kinds, ivory autoplasmic transplants, and blood-clot. From this series of experiments we selected examples of subperiosteal repair for the subject of this paper. The results of such experiments radically differed when the nutrient artery was cut, and when it was not cut.

In the first experiment the tibia was cut in two with a Gigli saw. The periosteum was not interfered with beyond the line of saw cut. The medullary canal was then reamed



Fig. 3. Animal Experiment N. 206. In this experiment defect in the shaft of the tibia was filled with sponge. Not subperiosteal bridge and complete function after three months.

repair of bone when the segments are held apart by magnesium rods. The occurrence of subperiosteal repair is apparent in the work of Albee and many others of our more recent writers.

Many striking examples of this phenomena occurred in a series of experiments undertaken with the idea of discovering some osteoconductive substance other than autoplasmic bone. The work of Fraenkel, Billroth, Gerter and Elberg has shown that inert foreign bodies in bone become encased with connective tissue while the work of Senn, Curtis and Murray with decalcified bone chips showed that in mere contact bone replaced absorbable material. In our experiments actual segments were cut from the shaft of bone and when healing occurred the results were entirely different from those mentioned above.

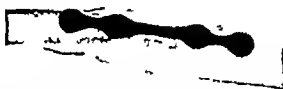


Fig. 4. Animal Experiment N. 8. In this experiment defect was made in entire shaft of tibia, medullary canal closed. A piece of bone kept fragments apart. Note deposition of bone in area not covered by periosteum. N. 21. 79 days after operation.

out and a wooden insert made. In this case the bone was contacted with bone. Last of all the nutrient artery was destroyed. This left the bone with only the blood supply from the epiphyseal artery and collateral circulation through the periosteal vessels.

This was sufficient to maintain the vitality of the bone but no well-marked subperiosteal involucrum formed. In this experiment the periosteum was left with all its properties but the osteoblasts were not stimulated by increased blood pressure in the medullary bone as they would be with normal blood supply.

Animal Experiment N. 7. Operated July 6, 93. X-ray taken on July 25, 93. Again X-rayed on August 5, 93. and autopsy on September 9. Result: non union. Absorption of bone in region of insert. Practically no subperiosteal callus. N. function.

In the next experiment the nutrient artery was left intact, and both abundant periosteal and endosteal bone resulted. The following experiment also shows the occurrence of periosteal bridge in bone with a normal blood supply.

Animal Experiment No. 306. Segment removed with bone cutting forceps. Bone held apart with Lane plate. Decalcified sponge was placed between the end of the shaft. Operation on June 26, 1913. X-ray on July 9, 1913. Showed marked thickening of the shaft of the bone and deposit of subperiosteal bridge. On July 25, 1913. X-ray shows a nearly



Fig. 6. Animal Experiment No. 304. I then examined the periosteum removed from entire circumference of bone. A tunnel was cut in the bone and constantly irrigated. Over this defect a piece of fascia secured. New bone formed under the fascia, but not elsewhere.

the gap. It looks as though the greatest production of bone had been near the middle of the defect and here there was no periosteum. On November 3, 1913 bridge nearly complete. Shows also anastomosis with the fibula endosteal bone. Autopsy on November 10, 1913. Shows bone of the subperiosteal.

Animal Experiment No. 36. Defect was made in the shaft of the tibia and a ferrule of bone was placed in this defect. The ferrule was of sufficient size to barely admit the end of the rat bone. The ends of the mutilated shaft were held apart with phosphor bronze plate. X-ray on October 21, 1913. Shows slight subperiosteal deposit. X-ray on

Fig. 6a. Animal Experiment No. 36. Defect in shaft of tibia surrounded by bone ferrule. Tibia has bronze plate. X-ray end of 3 days.  
Fig. 6b. X-ray at end of 50 days.  
Fig. 6c. X-ray at end of 60 days.

complete bridge. X-ray on September 3, 1913 showed complete bridge. In this case there was perfect functional result and no radiating sinus temperature or other evidence of infection. Post mortem on September 27, 1913. Subperiosteal bridge demonstrated.

The next animal experiment No. 35 shows that the periosteal bridge may extend beyond the normal confines of the periosteum. Fragment were held apart by bone insert and Lane plate. Operation on September 9, 1913. X-ray on October 3, 1913 shows new subperiosteal bone. This extended beyond the periosteum and began a bridge



Fig. 7. Enormous subperiosteal bridge complicating fracture of the tibia and a ferrule of bone was placed in this defect. The ferrule was of sufficient size to barely admit the end of the rat bone. The ends of the mutilated shaft were held apart with phosphor bronze plate. X-ray on October 21, 1913. Shows slight subperiosteal deposit. X-ray on

November 18, 1913 shows periosteal bone apparently deposited outside of the defect. X ray on December 9, 1913 shows a more like mass of bone covering horn ferrule.

These experiments show enormous subperiosteal developments and offer a marked contrast to the results with Lane plates. In our plate work the periosteum plays no great part in the process of repair unless the plate causes irritation. This is emphasized by the fact that following Lane's method of repair there is practically no increase in the diameter of the bone.

Heterotopic transplants of bone produce no subperiosteal bone as shown by the following experiments.

Animal Experiment No. 35 Shows piece of femur with periosteum transplanted to the anterior muscular abdominal wall. This has undergone slow atrophy as may be seen in the X rays taken six and twelve months afterwards.

Animal Experiment No. 340 Shows piece of skull transplanted to similar place and undergoes similar fate.

Animal Experiment No. 21 A piece of epiphyseal cartilage and bone was transplanted without any periosteum to the anterior abdominal wall. Shows beginning growth of bone after five months.

In all these experiments the bone was irritated and functionated, but no new subperiosteal bone resulted. This may be attributed to lack of blood supply or in one case to a very scant blood supply. The bone transplanted without periosteum is of too short life to tell the final results.

Animal Experiment No. 38 Shows result of section and irritation. The bridge is thick and more loosely confined to the periosteum than is usual with union alone.

Animal Experiment No. 4 Shows the result of substitution of fasciae for periosteum.

The conclusions from these studies are these:

Cutting the nutrient artery prevents the formation of subperiosteal bridge. As the nutrient artery supplies medullary bone and as the periosteum is left intact when the artery is cut we may assume that the medullary bone is responsible for the subperiosteal bridge.

Subperiosteal bridge may fill in gaps left in the periosteum, therefore is not absolutely dependent upon that structure even as a place of refuge.

Subperiosteal bridge is more marked where it receives osteoblasts from two sources than from one.

Fascia is a substitute for periosteum.

In heterotopic transplants, no subperiosteal bone could be produced by irritation. This is somewhat surprising in that the heterotopic experiments were conducted upon rabbits. We know that old scars in these animals frequently contain true bone, and that the periosteal device of Schepelmann begot bone in the peritoneal cavity.

At the present day the periosteum is disregarded. The present day surgeon may be comparatively indifferent to the periosteum when operating upon bone. If it is convenient he preserves it because the conservation of tissues is always good surgery, but if it is not convenient he does not hesitate to sacrifice it, knowing that it is not an essential element in the healing of bone.

Credit is due Dr. Frank Bissel for the X ray work.

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## AN EXPERIMENTAL STUDY OF SILK-TENDON PLASTICS WITH PARTICULAR REFERENCE TO THE PREVENTION OF POST-OPERATIVE ADHESIONS

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THOUGH there is no longer any question of the feasibility of the Lange silk tendon plastic for the lengthening of transplanted tendons, certain problems in the technique of the operation have not, as yet been fully answered. Chief among these is a satisfactory method of preventing post-operative adhesions. Lange himself has partly solved the problem by running the silk and the transplanted tendon through the subcutaneous fatty tissues. Though this method frequently gives excellent results, there always remain a number of cases in which an effective functioning of the transplanted tendon is rendered impossible by adhesions too firm for even a powerful muscle to overcome.

The following experimental study was undertaken at Professor Lange's suggestion to determine the nature of these adhesions and if possible to find a satisfactory method of preventing their formation. With this as

the prime object of our work there were also a number of secondary points at issue. They were, first, the nature and mode of development of the tissue which forms about the silk strands second the effect of function on this tissue third a determination on experimental data of how long the post-operative fixation must be maintained fourth, the degree and nature of the trauma inflicted on the transplanted tendon by threading the silk through it.

A statement of certain facts relative to the Lange silk tendon plastic is a necessary preliminary to the exposition of our own findings.

The Lange operation for replacing a paralyzed muscle consists in freeing the tendon and lower portion of a healthy muscle, as placed as to be a suitable substitute and threading it with two to eight strands of silk. The threading is done by a stitch devised by Prof. Lange (Fig. 1a). Recently it has been shown by Schede working in Lange's clinic that the strength of the stitch is increased by making

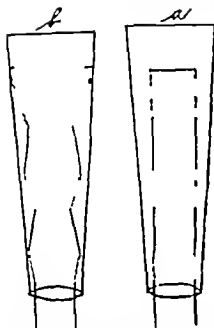


Fig. Diagram illustrating the Lange tendon study and the Schede modification. A, Lange method; B, Schede modification.

the longitudinal lines somewhat irregular in stead of keeping them in the same plane (Fig 1b). The tendon and the silk are then drawn through a tunnel in the subcutaneous fatty tissues to a point near the insertion of the paralyzed tendon where, by attaching the silk to the periosteum and underlying cartilage or bone a line of traction is established corresponding as nearly as possible to that of the inactive muscle. The adhesion which Lange has noted usually occur near the anterior surface of the tibia. They seemed to occur between the silk strands and the periosteum in those instances where it had been impossible to interpose a layer of fatty tissue but their exact study has never been undertaken.

After a successful Lange operation the silk can be felt as a distinct subcutaneous cord which gradually increases in size until frequently it reaches the diameter of an ordinary lead pencil. On three occasions Lange has had opportunity to examine the artificial tendon after it had functioned for two or more years. In all three the unding were essentially the same. The silk entirely unabsorbed in one instance with a connective tissue core was

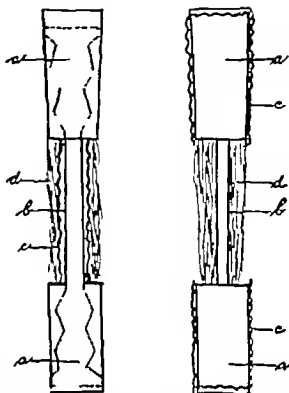


Fig. Diagram illustrating the control experiment. 1 and 2 tendon and b silk. Carpal membrane d, new forming tissue connecting tendon ends.

encased by a dense fibrous tissue which in the opinion of several expert microscopists was considered identical with true tendon.

It is unnecessary to rehearse in detail the extensive literature dealing with the healing of tendon wounds. The earlier researches of Pirogoff, Buzzozero, Paget, Adam, Demblow, de Velpeau, Billroth, Beltzow, von Ammon, Boner, Jeltz, Guterbock, and the more recent work of Viering, Busse, Linderlen, Schradick, Kraus, Yamagata, Marchand, and Seggel have shown that the tendon ends are rapidly united by a scar tissue to which the tendon sheath adjacent connective tissue, peritendinum externum and internum, and the tendon cells proper contribute in varying proportion. Eventually the tissue assumes the

Through the courtesy of Prof. Owen J. Pirogoff of the University of Chicago we were allowed to examine these specimens. It cannot be said that the results were entirely satisfactory, as the results with true tendon. The results were essentially the same as those with true tendon, but in some cases the results were not so good. The results were generally satisfactory, but in some cases the results were not so good. The results were generally satisfactory, but in some cases the results were not so good.

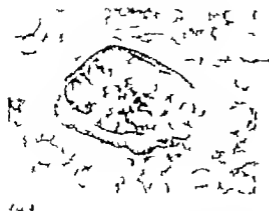


Fig. 3. Camera lucida drawing of fat transplantation surrounding the silk tendon, ten days post-operative. Cross-section showing the fibrous tissue replacing the fat. Experiment B. Immobilized ten days. Objective. Lens 3. Ocular. Tube 145. a, silk; b, envelope of epidermal cells transplanted with the fat; fibrous tissue replacing the fat transplant; d, fatty tissue.

microscopical characteristics of tendon, though even after 90 days it is much more cellular than normal (Seggel) and even after 243 days

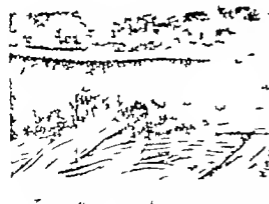


Fig. 4. Camera lucida drawing of artificial tendon, thirteen days post-operative showing (—) the organization of the blood clot about the silk, by fibroblast, arranged parallel to the silk, and (---) the cleft between the artificial tendon and the sheath. Experiment B. Immobilized thirteen days. Objective. Lens 3. Ocular. Tube 40. silk; b, blood-clot; fibroblast; d, cleft between artificial tendon and sheath. On cased endothelial like cells of sheath; f, blood clot in sheath.

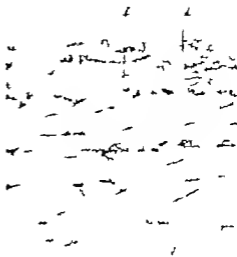


Fig. 5. Camera lucida of artificial tendon, fifteen days post-operative. The silk is drawn through the subcutaneous areolar tissue. The tendon stump in the proximal segment shows extensive necrosis and no evidences of regeneration. Despite this fact, well developed peritendon composed of dense connective tissue has already developed about the silk. Experiment C. Immobilized fifteen days. Objective. Lens 3. Ocular. Tube 40. a, silk; b, loose cellular tissue composed of poliblast leucocytes, lymphocytes, fibroblasts, etc.; c, dense connective tissue; its cells and fibers parallel to the silk; d, loose subcutaneous areolar tissue.

It has not the peculiar shimmer characteristic of normal tendon (Schrödl).

Borst and Seggel have also studied the changes after tendon plastics. In eleven operations performed by Hoffa—reeling of tendons, lengthening and suture of one tendon to another—and in fourteen similar experiments of his own Borst noted that healing takes place by a primary emigration of leucocytes and active proliferation of polyblast cells derived chiefly from the adjacent connective tissue. After the fourth day the true tendon cells showed their participation in the scar formation by great increase in their number and by numerous mitoses. He was able to distinguish between the mitotic figures of tendon and connective tissue cells and thereby reached definite conclusions as to their relative importance in the regenerative process. He found that simple tendon sutures healed much more rapidly than

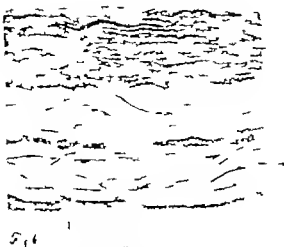


Fig. 6 Camera lucida drawing of newly forming tendon. A portion of the extensor digitorum tendon, ca. long was excised and further retraction prevented by anastomosing the tendon ends with the Lange stitch. The drawing illustrates the growth of true tendon-cells into the gap between the tendon ends. Control Experiment. Immobilized tendon (free tendon). Objectiv. Leitz 3. Ocular 4. Tube 4. a, silk b loose cellular tissue surrounding silk c, growth of young tendon-cell d, connective tissue

shortening by the Lange reefing stitch since in the latter a greater degree of necrosis was produced. This necrosis he considered due to the tension of the silk on the tendon.

Seggel in addition to a study of the healing of tenotomies, performed sixteen plastic in which 3-4 cm. of the Achilles tendon were replaced by silk strand as in the Lange operation. Within thirty-eight days the tendon ends were united by young tendon tissue; the process was completed eight days earlier in the ventral portion where the tendon sheath had been left intact. In nine of his experiments the silk was either extruded or torn out of the tendon without influencing the thought the reparative process. He concluded that neither tension nor function of the regenerated tissue determined its character but merely influenced the size of the newly formed tendon. His conclusion, however, can not be accepted without criticism, since in no instance was he able to maintain fixation of the operated limb.

Levy reached an opposite conclusion. By extirpating the muscle after tenotomies and by inserting silk strand between the tendon



Fig. 7 Camera lucida drawing of artificial tendon, sheath operation (only nine days post-operation) showing the dense fibrous tissue of the new tendon and the retention of the cleft between tendon and sheath. Experiment h, 3. Immobilized (twenty nine days). Objectiv. Leitz 3. Ocular 4. Tube 40. a, silk b, loose cellular tissue surrounding cells and others closely resembling young tendon c, cleft between artificial tendon and sheath



Fig. 8 Camera lucida drawing of cross-section of artificial tendon 44 days post-operation. Sheath operation showing: a) the cleft between newly formed tendon and the sheath, and b) the presence of connective tissue fibers encircling the silk. Experiment h, 3. Immobilized (eight days free thirty six days). Objectiv. Leitz 3. Ocular 4. Tube 40. a, silk b, loose cellular tissue about silk c, fibrous connective tissue showing circular as well longitudinal fibers d, cleft between tendon and sheath e, sheath

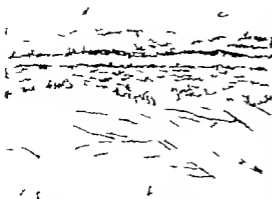


Fig. 9. Camera lucida drawing of artificial tendon, thirty-four days post-operation. The silk and tendon were drawn through the subcutaneous areolar tissue and the animal allowed to use the limb freely for twenty-four days after test day immobilization. The silk in this instance did not tear out of the tendon. The drawing illustrates the development of the artificial tendon, and of surrounding loose connective tissue, which allowed a union of the tendon. Experiment L<sub>2</sub> immobilized ten days, free twenty-four days. Left Objective. 3. Center. 4. Tube 40. a, silk; b, loose areolar tissue about silk; c, shown connective tissue closely resembling young tendon tissue; d, loose connective tissue, allowing motion of the tendon.

stumps pulling the new-forming tissue at right angles to the original line of traction he showed that the cells and fibers of the new-forming tissue ran parallel to this artificial line of traction, and that the gap between the tendon ends was thus bridged by a tissue which instead of running longitudinally as after the usual tenotomy ran transversely.

The most recent work on tendon plastics (Sever<sup>11</sup>) differs radically from the preceding in attributing no regenerative power to the tendon cells proper. He considers the all important tissues to be the tendon sheath and the peritendinium unless they are present, true tendon regeneration is impossible. The peritendinium therefore, corresponds in function to the periosteum. He found that if the sheath and peritendinium were preserved and function allowed early adhesions may not occur. Without the sheath adhesions occur more frequently.

Our attempt to solve the problem of preventing adhesions is based on 54 operations performed on rabbits of varying age from young (two or three months old) to full grown. We include here only those cases in which

healing was aseptic, except in one instance, where the microscopical evidence of a localized infection of the tendon stump enabled us to demonstrate an important point in the development of the artificial tendon. In the earlier operations the tendo Achillis was used and to lessen the tension on the sutures the leg was fixed in extension. This position, however, seemed to give the animals much inconvenience and prevented them from hopping about freely. We, therefore, used the muscles of the anterior and medial groups—the tibialis anticus, extensor digitorum, extensor hallucis, and flexor digitorum. These tendons were indeed much smaller than the Achilles tendon and increased the difficulty of the operation, but by using them we could fix the leg in flexion. We immobilized and also kept the dressing dry and clean by coating the gauze bandage with celluloid dissolved in acetone. Absolute fixation was not possible, since owing to the give of the gauze about 5° of motion took place at the ankle joint. The fixation, relative though it was, was an important part of the operative procedure, since by varying the period of immobilization we secured data to determine when it was expedient to allow functioning of the transplanted muscle.

In the first series of operations we wished to determine under the simplest conditions,



Fig. 10. Camera lucida drawing of tendon end, twenty days post-operative illustrating the extensive necrosis of the tendon. Experiment H<sub>2</sub> immobilized twelve days. Objective. 7mm. A. Center. Tube 120. a, longitudinal silk strand; b, transverse silk strand; c, necrotic tendon of living tendon with great necrosis in cells; d, peritendinous cells.

the relative efficiency of various methods of preventing adhesions. Accordingly we excised one-half cm. of a tendon either the Achilles or the extensor digitorum—in some cases simply divided the tendon allowing a retraction of the tendon ends for one to one and one-half cms. Further retraction was prevented by uniting the tendon ends with the Lange stitch. No attempt was made to unite the tendon sheath; often in fact, it was removed in large part so that it could not contribute to the prevention of adhesions.

First, four control experiments were performed (A 1 2 3 4). In A1 the leg was simply immobilized for twenty-seven days without operation. On removing the bandage the leg was freely movable. In A2 the simple tendon plastic as just described was performed on the extensor digitorum and the leg immobilized in 90° flexion for ten days. Examination then showed that it was impossible to extend the leg beyond 100°. The animal was allowed to use the leg freely for three days and the specimen then obtained. Extension had already increased to 125°. The tendon ends were adherent to the skin, sheath of the tibialis anticus and the adjacent tissues, but the adhesions were sufficiently



Fig. Camera lucida drawing of tendon end, seven days post-operative, showing mitotic figures in tendon cell. Experiment 1. Immobilized seven days. Objective Zeiss, oil-immersion, Ocular 8. Tube 14. a, peritendoneal cells; b, living tendon; mitoses in tendon-cell.

lax to permit the tendon to functionate. The gap between the tendon ends was already bridged by a fibrous tissue about half the thickness of the tendon completely enveloping the silk strands. The experiment showed first the tendency of the tendon ends to form adhesions; second, the effect of function of the tendon in stretching these early adhesions; third, the rapid formation of a tissue uniting the tendon ends when the diastasis between them is bridged by silk strands. In A3 a similar operation was performed and, to determine the effect of a longer fixation period, the leg fixed for thirty days. Here immediately after removing the bandage, the leg showed only the 5–10° of motion allowed within the celluloid splint. The animal was allowed to use the limb freely for ten days and then autopsied. Extension had become normal. Abundant adhesions were present about the site of the operation as in Experiment A2 but were so stretched as to allow perfect function. The gap between the tendon ends was completely replaced by a dense tissue difficult to distinguish from the normal tendon. In A4, to produce another type of adhesion, the periosteum was purposely in-



Fig. Camera lucida drawing of tendon end twenty days post-operative illustrating the reduction in the extent of the necrosis and its limitation to the area distal to the transverse silk strand. Experiment 1. Immobilized ten days, five ten days. Objective Winkler. Ocular Tube 140. a, longitudinal silk strand; b, transverse silk strand; c, necrotic tendon; d, living tendon with great increase in cells; e, peritendoneal cells.



Fig. 3 Camera lucida drawing of the Carle skin graft thirty days post-operative, showing the loose connective tissue of the tissue surrounding it. Experiment I. Immobilized ten days, free ten days. Objective. Winkel 42. Ocular Lens. Tube 20. Carle membrane is giant-cell, phagocytic, keratinocytes, lymphocytes, fibroblasts and young connective tissue.

Fig. 4 Camera lucida drawing of the Carle skin graft thirty days post-operative, showing the increase in the amount of connective tissue surrounding it. Experiment II. Immobilized fifteen days, free twenty-one days. Objective. Winkel 42. Ocular Lens. Tube 20. a. Carle membrane. b. young connective tissue.

jured and the leg immobilized for 30 days. The resulting adhesions to the bone held the tendon end so firmly as to absolutely prevent function.

The first means of preventing adhesions that suggested itself was the implantation of a body tissue between the operated tendon and periosteum. In view of Langer's success in preventing adhesions by running the silk strands through the subcutaneous fatty tissues, fat seemed to us the most suitable tissue. The difference in the operative conditions which exist between the human subject and the rabbit must however be emphasized. The rabbit must however be emphasized. The rabbit has no subcutaneous fat except in the region of the groin and shoulder. Therefore no analogy can be drawn between Langer's technique and our experimental procedure. In four experiments (B 1, 2, 3, 4) a piece of fat taken from the groin of the operated animal was placed about the tendon ends and the intervening silk. The leg was immobilized and the specimens obtained after ten, eleven, thirteen and sixty-nine days. In all four even after ten days, dense adhesions

were present due as the microscopical preparations showed to the replacement of the fat by fibrous tissue.

In Experiment C a homoplastic transplant of cartilage from the ear was interposed between the operated tendon and the periosteum. The leg was fixed twenty days, freed for nine days. At autopsy dense adhesions of all the tissues near the site of the operation were found and only a light degree of mobility present.

The lack of success attending the implantation of living tissues led us to try inorganic material. In Experiment D the tendon ends and the adjacent tissues were well covered with sterileaseline to which for the sake of asepsis, bismuth substrate had been added. The leg was immobilized for twenty one day and then the animal allowed to use the limb freely for four months. Immediately after the fixation period the leg was immovable even after the four months of freedom motion remained considerably restricted. Autopsy

showed in this instance, also abundant adhesions and impaired muscle function.

Somewhat more success attended Experiment E, where the tendon and silk were enveloped in a tube of thin rolled silver. At autopsy after thirty days immobilization the silver tube was adherent to the tendon and the adjacent tissues but the adhesions to the tendon were sufficiently lax to permit a moderate degree of function. The method had the evident disadvantage of producing an unsightly bulky prominence. Consequently we tried to overcome this objection by making the tube of two longitudinal sections one sliding over the other to each of which a long silk suture was attached and brought out of the upper angle of the wound. We hoped after ten days to remove the sections by traction on the sutures, but the procedure proved difficult necessitating almost a secondary operation and the method was therefore discarded.

Though the research originally planned a study of the Lange silk tendon plastic it seemed wise in view of our first failures, to attack the problem on a broader basis. We therefore substituted a strip of aut plastic fascia for the silk. Two operations were performed both on the quadriceps tendon. In Experiment F the leg was fixed twenty-four days, freed thirty-eight days. In F<sub>2</sub> fixed twenty-eight days freed fourteen days. In both the function of the muscle was markedly impaired, first by dense adhesions, second by the stretching of the transplanted fascia and of the scar tissue uniting it to the quadriceps tendon.

In Experiment G we attempted a further modification by transplanting a portion of the plantaris tendon to replace the resected quadriceps tendon and then inserting between it and the bone a strip of rabbit's vena cava preserved in 4 per cent formalin and thoroughly washed in sterile saline before the operation. Despite the complicated procedure, the healing was perfect, but the function of the quadriceps was entirely lost by adhesions and by stretching of the transplanted tendon and scar tissue.

The successful healing in of the formalinized vein led us to try further experiments with

preserved animal tissues. The most practical seemed to us the preparation of pig's bladder known as Cargile membrane. Of this two varieties are procurable—the chromicized and the non chromicized. We used the chromicized.

After the usual operation on the extensor digitorum, the tendon ends and the intervening silk strands were completely enveloped with a strip of the membrane rolled so as to form an artificial sheath. The leg was fixed seven weeks freed for two. The result was a tendon so nearly the normal in function and appearance that it was difficult to determine which leg had been operated on. Gentle traction on the muscle produced extension of the toes. No adhesions were visible, and the site of the tendon resection was macroscopically indistinguishable.

To test the efficacy of the procedure carefully eight similar operations were performed on the extensor digitorum and Achilles tendon (H 1-5) ranging in duration from twelve to one hundred and thirteen days the free period from none to one hundred days the period of fixation from nine to twenty three days. In all the animals which were allowed to run about freely for even a few days after removing the fixation bandage, the final functional result was excellent. Immediately after the fixation period, however the legs were without exception movable to only a slight degree. In the rabbit autopsied at this stage the Cargile membrane was found adherent to the skin by a thin tissue which stripped away easily. The tendon moved backward and forward within the Cargile sheath for about 1 mm. that is, it showed the range of motion allowed by the celluloid splint. The Cargile membrane therefore did not prevent adhesions. The adhesions however to which it gave rise unlike those attending the implantation of the other substances tested, were of a kind which, under the simple conditions of this experiment yielded to the contraction of a healthy muscle. The microscopical pictures evidence the comparatively loose type of tissue surrounding the membrane. A week after the operation it was closely invested with leucocytes and cells of the polyblast type (Maximow) with only a

few fibroblasts present. Gradually the fibroblasts increased in number until by the twentieth day they formed the predominant cells. By the thirty sixth day the tissue had become distinctly more fibrous, but, even as late as sixteen weeks after operation, shreds of the membrane were in many places still unabsorbed and the tissue about it comparatively loose in character.

Too great an effect, however, should not be attributed to the membrane. It must be remembered that in control experiments A<sub>2</sub> and A<sub>3</sub> in which the tendon was not ensheathed with Cargile membrane the functional results were also good. Further the microscopical sections showed that the membrane did not form a smooth investing sheath but one with numerous folds, some of which are seen in Fig. 14. Between these folds the tissue was frequently as dense as the surrounding connective tissue only in the immediate proximity of the membrane did it possess the loose character above described. Owing to these complicated foldings it seems to us improbable that the line of cleavage for the motion of the tendon occurred exactly in the plane of the membrane. In fact, in two of the experiments of the next series we could prove conclusively that the motion did not take place in this plane but that the membrane was completely enclosed by newly formed tendon and could not, therefore, act as its sheath.

In the series (I 1 2 3 4) performed as a further test for the efficacy of the Cargile membrane it was in the first two wrapped only about the tendon ends, in the second two only about the intervening silk (Fig. 2). In these two latter the newly formed tissue uniting the tendon ends would include the Cargile membrane and therefore inhibit its usefulness. The microscopical examination of the specimens recovered after twenty days showed that this had actually occurred, but the functional result in rabbit I<sub>3</sub> was fully as good as that in I<sub>1</sub> and I<sub>2</sub> where the membrane had been so placed as to be effective. In rabbit I<sub>4</sub> however the function was somewhat impaired. It is possible that this inferior result was due to the inclusion of the Cargile membrane within the newly formed tissue

whereby its effect as a sheath was lost. On the other hand, in the face of the excellent functional results secured in Experiments A<sub>2</sub>, A<sub>3</sub> and I<sub>3</sub> where the tendon was not ensheathed within the membrane, we are not justified in assuming the inferior result in I<sub>4</sub> to be due to its absence. This may just as well have been due to slight errors in the operative technique—more extensive traumatization, or hemorrhage or less accurate insertion of the tendon stitch. We have therefore no convincing evidence for the efficacy of the Cargile membrane. That it does not exaggerate the tendency to adhesions, as did the transplanted tissues and the foreign bodies tested by us, is positive. That its effectiveness after six weeks is gradually lost and further immobilization contra indicated is also positive. That it may help secure a good functional result if mobilization is begun before that period is possible but the results of our experiments do not warrant us in maintaining this effect to be more than a possibility.

In the next series of experiments, at Professor Lange's suggestion, we attempted reducing the period of fixation by early faradization of the operated muscle. It is true that against this procedure speak the experience of Seggel, Hoffa and Borst, all of whom, after careful experimental work, advised long post-operative fixation. Still we wished to determine whether faradization could prevent the adhesion to the bone which Lange had observed in clinical cases and which we had observed in control Experiment A<sub>4</sub>, where we had purposely injured the periosteum. In two instances, therefore, after the usual operation on the extensor and flexor digitorum respectively in both of which the periosteum was purposely traumatized, the rabbits were given daily faradization. In both animals the results were the same. At first the rabbit's claw responded briskly to the stimulation by movements of extension or flexion but gradually the response diminished until eventually even with a strong current, the claw could not be made to move. Autopsy of both rabbits showed dense adhesions to the periosteum. A third experiment (J<sub>3</sub>) in which care was taken not to injure the periosteum, was then performed to determine whether faradization

could prevent such adhesions as noted in control Experiment A3. Stimulation was begun the third day after operation. For the first five days all the claws responded vigorously. Thereafter though the muscle could be felt to contract the claws responded but slightly to a very strong current and after a few days failed to respond at all. Faradization was continued daily for twenty days then the rabbit was autopsied. The silk was found entirely torn out of the distal stump of the tendon, allowing a diastasis of 3 cm. between the tendon ends. This gap was filled with scar tissue which bound down the distal end of the tendon, but there was no strong bridge uniting the tendon stumps. Consequently traction on the proximal portion produced no motion of the distal. This tearing out of the silk corresponds with similar observations in subsequent experiments where early mobilization was attempted, and with the microscopical evidence of extensive necrosis of the operated tendon.

The final series of our preliminary experiments gave unqualifiedly the best results. The method was suggested by Blesalski in an article on "The Exchange of Tendon Sheaths." In several cases of anterior poliomyelitis he withdrew the paralyzed tendon from its sheath and brought the substituting tendon down through this sheath to its new insertion. We tried the same method, using the Lange silk tendon, so as to test the value of the method in those cases in which the transplanted tendon proved to be too short. To make the operative conditions the simplest possible, we used only one muscle for the entire procedure — the tibialis anticus.

The sheath was opened near the insertion of the tendon: a long suture passed through the tendon: the tendon severed distal to the suture and drawn through a second incision made over the muscle belly. As the tendon was withdrawn a portion of the silk was pulled up through the sheath with it. There is in reality no true tendon sheath here in the strict sense of the word. There is instead a fascial compartment in which the tendon glides freely corresponding exactly to the fascial compartment in which the human tendo Achillis runs. Though the tendo

Achillis possesses no true tendon sheath (Spalteholz) the fascial compartment is so nearly its functional equivalent that the term "tendovaginitis" applied to the Achilles tendon is in general good usage. We shall consider these fascial compartments of the rabbit as the equivalents of the tendon sheaths and hereafter not attempt to differentiate between the two. Three or four centimeters of the tendon were resected, the remaining stump threaded by Lange's method, and by traction on the distal end of the suture the tendon pulled within the sheath. The distal end of the suture was then fastened near the original insertion. We thus had substituted a silk suture for the distal 3-4 cm. of the tendon and run the silk through the sheath of the tendon.

Six operations were performed of from eight to forty four days' duration (K. 1-6). In three animals the specimens were obtained immediately after the fixation period at eight, thirteen, and twenty nine days respectively. The other rabbits were given eight to thirty-six days of freedom after one to two weeks fixation. In all the animals, whether immobilized or free, the results were the same: perfect function was secured. Even after twenty nine days fixation the operated tendon moved within the sheath as freely as the normal. Microscopical preparations showed this to be due to the preservation of the normal space between the tendon and the sheath.

All the experiments thus far cited constitute a preliminary series. They were performed under the simplest operative conditions more nearly analogous to those of a transverse tenotomy than to those of a complicated human tendon plastic. The muscle and tendon were left *in situ*; therefore the adhesions occurring during the process of healing were likely to be stretched by the normal motions of the animal. The experiments showed first that adhesions under these conditions could be entirely prevented by running the artificial tendon through the tendon sheath; second, that in the absence of periosteal irritation the healthy muscle could, unaided, overcome the adhesions to its tendon; third, that autoplasmic transplants preserved animal tissues or foreign bodies, introduced as an

artificial sheath tended with the exception of Cargile membrane to exaggerate rather than to inhibit the adhesions. The Cargile membrane however possessed only a questionable value whose period of possible usefulness did not extend beyond five or six weeks.

It now remained to study the changes occurring after tranplants more nearly analogous to those in the human and to determine whether the law learned in the preliminary experiments could be applied to these more complicated conditions.

In Experiments 11 to a muscle of the rabbit mesial group either the extensor hallucis or the digitorum was threaded as in the typical Lange operation and divided distal to the suture. Through a second incision over the external surface of the tarsus the silk thread and the proximal portion of the tendon were drawn through the subcutaneous tissues and fastened near the insertion of the peroneus. Ten experiments were performed ranging in duration from seven to fifty nine days the fixation period from seven to thirty days, the free period from none to twenty nine days. The technique of the operation was by no means simple. In the first place the tendons were small—only three-fourths mm.—in diameter and difficult to hold with the suture. In the second place, they rested directly against the periosteum of the tibia, so that an injury to it was sometimes unavoidable. Yet these difficulties were in a way advantages, since they were exactly those difficulties exaggerated which confront the surgeon in the human operation. Our failures, therefore, illustrated the errors which must be avoided in performing a tendon plastic. In four cases the silk tore out of the tendon. The microscopic examination showed that this was probably due to the extensive necrosis of the tendon produced by the suture (Fig. 10). If the silk does not tear out entirely it may slip downward in the tendon to such a degree as to lose the necessary tension. This happened in a fifth experiment where at autopsy the silk was found so lax that strong traction on the muscle could not make it tense. Of course in the human where the tendon is larger and the longitudinal

stitches can be taken in several planes, the danger of tearing out is distinctly less still, no one can have performed many silk tendon plastics without noting the tendency of the sutures to slacken. This tendency to necrosis constitutes the all important reason against early functioning of the operated tendon after the Lange silk tendon plastic also, as already mentioned against irradiation as a means of preventing adhesions. A sufficiently long time must elapse after the Lange operation for the tendon to recover from the trauma it suffers, so that its cells—the tendon cells proper and those of the peritendinium—will be enabled to reduce the necrosis to a minimum. A certain amount of slipping is from the nature of the operation inevitable to allow for which the operated limb must be fixed in extreme over-correction. The fixation should last five to six weeks by that time the reparative power of the tendon has reduced the area of necrosis to a negligible amount.

The second important fact taught by this series of experiments is that adhesions after the Lange operation, occur not to the silk, as had been previously supposed but to the tendon end. In all ten experiments the silk was found to be freely movable in its long axis and from side to side even when it ran directly over the periosteum, whereas adhesions more or less firm were constantly present to the tendon end. The adhesions were absolutely fast in two cases where owing to injury to the periosteum, a small bony tubercle had formed in which the tendon was caught. They were most lax, allowing 3 mm. of motion of the tendon end in one instance where an unusually vigorous animal was allowed to use the leg freely for twenty four days. These facts correspond with those noted in the preliminary experiments, where it was shown that a powerful muscle could stretch some adhesions, but adhesions produced by periosteal irritation would not yield.

The final experiments had to determine whether the adhesions to the tendon end after a typical transplantation could be prevented or their danger lessened, either by enveloping the tendon with Cargile membrane or running it through the tendon sheath.

In Experiments M1-5 a muscle of the medial group was again transplanted as in Experiments L and the tendon end sheathed with Cargile membrane. Three experiments were performed of five ten and thirteen days duration with complete fixation till autopsy and then an additional two in which, following Biesalski's suggestion, fish bladder was used instead of the Cargile membrane. In the first Cargile experiment the periosteum was injured and the tendon end was found firmly adherent after only five days. In the second and third the membrane was only loosely adherent to the tendon and adjacent tissues and 3-5 mm of motion was noted. The movement took place partly by a gliding of the tendon end within the Cargile sheath, partly by a gliding of the Cargile membrane on the surrounding tissues. In the first fish bladder experiment the result corresponded with that noted when the Cargile membrane was used. In the second however after thirty four days the tendon end was found embedded in dense adhesions. It is possible that this result was due to the inferiority of the fish bladder to the chromicized Cargile membrane, but this conclusion is by no means certain, since in the corresponding experiments in which the Cargile membrane was used (M1-2-3) the period of immobilization was much shorter. The close resemblance between the two membranes however gives ground for skepticism as to the value of the Cargile membrane had it been used here instead of the fish bladder and confirms the conclusion deduced from the preliminary experiments that the membrane has only a questionable efficacy in preventing adhesions.

In the final series of experiments (N1-3) the tibialis anticus tendon and the silk prolongation were run through the sheath of the peronei. The duration of the experiments was three six and fourteen days. Unfortunately this series is incomplete since in a fourth experiment of forty days fixation the silk was found at autopsy torn out of the tendon and the tendon end retracted. In this instance the tendon was embedded in adhesions. In the three experiment in which the

tendon sutures held the results corresponded with those in the preliminary series of experiments (K1-6). Within the peroneal sheath the transplanted tendon and the silk strands were entirely free from adhesions and showed the normal range of motion. Adhesions were, however present to the tendon in its course from the normal situation to the sheath of the peronei. This was best seen in the unsuccessful experiment of forty days duration, where the tendon end had retracted out of the sheath and was held fast by adhesions. The freedom from adhesions to the tendon within the sheath stands out as the essential fact of our research study. To prevent adhesions in tendon plasties, restore the normal relationship of the tendon to its sheath.

*Technique.* A slit was made in the sheath of the peronei just distal to the external malleolus, a suture passed through the tendons, the tendons divided distal to the suture, withdrawn with the attached silk through a second incision over the proximal end, and amputated. The tendon of the tibialis anticus was freed threaded with the suture drawn down into the sheath of the peronei and anchored by the distal end of the suture.

In addition to a study of adhesions and their prevention the research purposed a consideration of several other points at issue. The first of these is the nature and mode of development of the tissue surrounding the silk strands. The silk strands and the blood-clot adherent to them are at first invested by leucocytes lymphocytes and cells corresponding to the type termed "polyblasts" by Masumow. These cells are also known as lymphocytoid cells, or "wanderzellen." As the name polyblast implies, they show many varieties of form circular or polygonal (in section) regular in outline or with numerous processes. Their origin is still a problem of debate—whether they are derived from the lymphocytes or from the fixed connective-tissue cells or both. Mingled with them are a gradually increasing number of fibroblasts. The number of leucocytes varies markedly depending probably upon the grade of asepsis; in some preparations they were present to the exclusion of all other cells. In other preparations they were the exceptional cell

The fish bladder was prepared according to Biesalski's method by forty-six to sixty minutes in formalin 1% in early alcohol boiling and preservation in 95 per cent alcohol.

type. By the thirteenth day the fibroblasts are the dominant cells together with a smaller number of polyblasts and leucocytes they form a layer immediately surrounding the silk. External to this lies a zone of dense fibrous tissue similar to young tendon tissue, varying in width, but in the average twice as broad as the cellular zone. It is composed of long pale staining cells, lying in a dense fibrillar matrix. Almost all the cells and fibers run parallel to the silk strands, but in cross sections a number can be seen encircling the silk. It is equally well developed in the experiments where the silk strands were run through the sheath and in those where they ran subcutaneously. Though it is somewhat better developed near the tendon stump than in the distal portion, there is not sufficient difference in the grade of development to justify the theory that it is derived entirely from the tendon. The tendon undoubtedly contributes to its formation, for the tendon cells show active proliferation as evidenced by numerous mitoses, and can be seen growing in long sheaves into the primary loose cellular tissue (Fig 6). In one specimen, owing to severe trauma and slight infection, the tendon-cells even after two weeks showed little reaction, but this dense, tendon-like tissue was no less well developed (Fig 5). In another where the silk had been run into the muscle, it was well developed about the intramuscular strands. We must, therefore, assume that it is formed in great part by connective-tissue cells which assume the characteristics of tendon-cells and arrange themselves in long parallel columns.

In the further process of growth the tendon like tissue becomes more fibrous and less cellular and gradually enlarges centripetally at the expense of the loose tissue immediately surrounding the silk, and centrifugally at the expense of the tissues external to it. By the thirtieth day (Fig 7) it resembles young tendon tissue closely but can be distinguished from it by the length of the nuclei, the true tendon cells and nuclei being longer second, by the texture of the fibers. True tendon even when young has a peculiar shimmer not acquired by connective tissue. There are indeed places where these criteria fail. These

are usually situated near the stump of the operated tendon where the new formed tissue is composed partly of tendon cells, partly of connective-tissue cells, and, therefore, partakes of the character of both tissues.

For this peculiar type of connective tissue we must assume the traction on the silk to be responsible. A strand of silk not subjected to such traction—an ordinary ligature for example—is enveloped by a loose connective tissue in which the fibers run in all directions. In those instances where the silk was for a time subjected to traction, but later tore out of the tendon, we found many fibers running parallel to the silk, but their degree of development was distinctly less than in those cases where the artificial tendon functioned. Levy also in the ingenious experiment already referred to, where, after tenotomy and excision of a portion of the muscle, an artificial line of traction was introduced between the tendon ends at right angles to the normal, demonstrated conclusively the effect of traction in causing an alignment of the connective-tissue fibers parallel to the line of traction. We have, therefore, every reason to believe that the pseudotendinous structure enveloping the silk is due to its functioning as tendon. It must, however be emphasized that the growth of this tissue, though rapid during the first few weeks, is subsequently slow that even after forty-four days the amount of pseudotendon is little greater than after twenty days, and that it is then far from being sufficiently strong to withstand the tension to which the normal tendon is subjected. The silk must, therefore, be of sufficient tensile strength to act as an effective substitute for the tendon. Several of our experiments could not be included among those herein described since we failed to realize the importance of this fact and used silk of insufficient tensile strength which snapped even before mobilization of the tendon was attempted.

The final question which our research attempted to answer was a determination of the period of post-operative fixation. To this we have already referred. Here two conflicting factors must be considered first, the danger of the silk tearing out of the tendon second, the danger of adhesions. Evidently the longer

the fixation the less the former danger the greater the latter. A mean therefore has to be found between the two.

The trauma of the operation produces an extensive necrosis of the tendon. This is most marked in that portion included by the silk strands but is also present external to the silk (Fig. 10). In a few instances the necrotic area was invaded by leucocytes, but as a rule it was not—an indication that, as Borst already suggested we are dealing with a variety of bland necrosis. To restore the injury an intense proliferation of the true tendon cells and of the cells of the peritendinum internum takes place. In specimens of seven, ten, and fourteen days, however the necrosis is still very extensive. This necrosis cannot be considered an absolute argument against mobilization of the tendon, but only as a relative factor. In almost all the experiments of the first series, where after tenectomy the tendon ends were joined by silk strands, early mobilization did not cause the silk to tear out. It must be remembered however that under these conditions the tendon ends are rapidly united by young tendon and connective tissue which relieves the strain on the silk. The conditions in a silk plastic operation are quite different. Still even in the true plastics, the silk held in a number of experiments despite removal of the fixation bandage ten days after the operation (Fig. 9). Moreover in two silk tendon plastics where we had a chance to test the security of the tendon stitch during the first fourteen days, it showed surprising strength withstanding a strain of one and one half kilos. In six experiments where early mobilization was also attempted, the silk tore out or became lax. It also tore out in four experiments despite the fixation owing to undue tension which had been put upon it. We must, therefore decide, despite the favorable results seen in some instances of early mobilization, that it is wiser not to risk tension on the silk during the period of extensive necrosis.

The repair of the necrosis takes place first in that portion of the tendon external to the silk strands, and last of all in that portion lying directly distal to the transverse stitch. It is an unfortunate fact that the portion of

the stitch which has the firmest hold on the tendon—the transverse strand—produces the most lasting necrosis. Where the tension is greatest, just distal to the transverse strand the necrosis persists the longest. Here it can be seen in all the specimens of twenty days duration (Fig. 2).

After thirty six days, though it is still present in this situation it has been reduced to a negligible amount by the ingrowth of the surrounding tendon and peritendineal cells whose activity is indicated by frequent mitotic figures. Our study of the necrosis produced by threading the stitch through the tendon brought us to the conclusion that, though early mobilization of the tendon after the Lange operation may give good results in some instances, it is wise to give the tendon ample opportunity for repair by keeping it at rest five to six weeks.

We must be cautious in applying these experimental observations to surgical practice. Most of the human tendon plastics are performed for paralyses due to anterior poliomyelitis, in patients whose trophic neurones, as well as the motor have suffered more or less degeneration. We must, therefore, in determining the period of post operative fixation for the human, vary it according to the degree of trophic disturbance evidenced in each individual instance. The discrepancy between the rabbit and the human patient is even more marked when we consider the other factor of post-operative fixation—the tendency to adhesions. Certain facts undoubtedly hold good for both experimental animal and human being that adhesions can be prevented by restoring the normal relationship between tendon and sheath, and that all artificial methods of constructing or replacing the sheath by implanting tissues or foreign bodies defeat their own ends. In our animal experiments it was impossible to test accurately the effectiveness of Lange's method of preventing adhesions by drawing the tendon and silk through the subcutaneous fatty tissues, since the rabbit possesses practically no subcutaneous fat. We are therefore unable from our data to determine how long fixation should be maintained after a silk tendon plastic upon the human patient.

## SUMMARY

Our experimental study of the Lange silk tendon plastic indicates that the one effective method of preventing post-operative adhesions consists in a restoration of the normal anatomical relations of the transplanted tendon to its environment. This is best done by Blesalaki's method of running the transplanted tendon through the sheath of the paralyzed. All artificial methods of preventing adhesions by implanting living tissues or interposing foreign bodies defeat their own ends, since they exaggerate rather than inhibit the tendency to adhesions. The one possible exception is Cargile membrane. This may for five or six weeks, help slightly to prevent dense adhesions, but the results of our experiments do not warrant us in maintaining this effect to be more than a possibility.

The adhesions after the Lange operation occur not to the silk but to the end of the transplanted muscle or tendon. The tendon itself subsequent to the operation shows extensive necrosis, from which, however it recovers in from five to six weeks. During this period it should be kept at rest, and undue strain or tension on the silk strands should be avoided.

The tissue enveloping the silk strands consists of a dense fibrous tissue almost all of whose fibers and cells run parallel to the long axis of the silk. A smaller number encircle the silk. It is developed essentially from the adjacent connective tissue, though the true tendon-cells and the cells of the peritendinum and tendon sheath also contribute to its formation. The arrangement of its fibers and the degree of its development depend upon the functional demands to which it is subjected. Anatomically it is not tendon. It must be emphasized that its development, though rapid during the first few weeks, is

subsequently slow. The major share of the tension must for a long time be borne by the silk strands. Therefore, they must be of sufficient tensile strength. Therefore there is also necessity of long post-operative fixation, allowing the tendon to recover from the necrosis subsequent to the operation and insuring a firm union between the silk strands and the stump of the transplanted tendon.

The research was performed in the surgical laboratory of the Königliche Orthopädische Universität a Poliklinik, München, Professor Fritz Lange, and in the Königliche Pathologische Institut der Universität München—director Professor Max Borst.

We wish to acknowledge our great indebtedness to Professor Lange for suggesting this research, for placing all the facilities of his surgical laboratory at our disposal, and for his constant interest and advice, and to Professor Borst for our courteous reception in the Pathological Institute and his confirmation of our microscopical findings.

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ON THE PATHOLOGY AND TREATMENT OF CHRONIC LEUCORRHOEA<sup>1</sup>

## A STUDY OF THE CAUSES OF PURULENT VAGINAL DISCHARGES AND THE RESULTS OF VARIOUS KINDS OF TREATMENT

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THE study of chronic leucorrhoea was undertaken chiefly because so much concerning the subject has remained a mystery. In the two years devoted to the work, a liberal amount of dispensary material, added to unusual opportunities for the study of private patients, has made it possible to follow a considerable number of cases. Eighty-five of these have been subjected to thorough bacteriological study.

*Types of patients in which purulent discharges occur.* The vast majority of cases of chronic purulent vaginal discharge in women who have not been pregnant are consequent to gonococcal infection. Such at least, is the evidence from observation of dispensary and private patients made with the special object of determining this point. In virgins and other nullipara whose history and local findings exclude suspicion of specific infection, discharges other than those of a mucous nature are not usual when found in these cases free from venereal disease, mucous secretion is usually associated.

In women who have borne children additional factors which appear to lead to purulent leucorrhoea are infections associated with pregnancy, altered anatomical relationships consequent to labor, loss of elasticity of tissues, and increased mucus. (A consideration of cancer is scarcely within the scope of this paper and is purposely omitted.)

*Place of formation of discharges.* To decide whether uterine infection exists in cases with chronic discharge the cervix has been regularly exposed to view and observed. It has also often been dilated to assure free drainage during the period of observation. Cultures were made from the uterus obtained at operation in several instances, and likewise from scrapings from a dozen patients with leucorrhoea. The net results have been a failure

of almost all attempts to discover a purulent discharge from the uterus, and negative findings in the smears and cultures. It therefore appears that purulent discharges are formed in the lower genital tract and rarely consist of bacteria-laden material from the uterine cavity. It must at the same time be remembered, however, that mucus comes from the cervix and that this mucus may form culture material for vaginal bacteria.

## BACTERIOLOGY OF LEUCORRHOEA

The results of a study of the bacteriology of leucorrhoea have been reported as a preliminary to the present contribution. A consideration of findings as there recorded and of recent results obtained is desirable before entering upon a discussion of treatment.

Secretions from the uncontaminated vagina, i. e. secretions from children and from women who have not had intercourse, also those from a surprisingly large number of married women, contain almost exclusively the large gram-positive vaginal bacilli of Döderlein (Fig. 1). The other extreme is represented by the bacteria found in profuse leucorrhoeal discharges (Fig. 2). In an intermediate group belong the secretions from most married women; these present a gradation from normal to leucorrhoeal bacterial content, the organisms present in each instance depending upon the amount and character of the vaginal flow.

I have succeeded in isolating and determining the cultural characteristics of a considerable number of bacteria common to leucorrhoea. Many of these are already well known. Others notably anaerobes, have not been previously described. A detailed discussion of most of these various organisms is included in the former report.

<sup>1</sup>On the Etiology and Bacteriology of Leucorrhoea. *Bull. Gynec. & Obst.* 1914, 3:164, 197.

Characteristic of smears and cultures from leucorrhoeal discharges is the preponderance of anaerobic bacilli. Cultures from the external genitalia in contrast with higher vaginal cultures contain more aerobes, notably bacillus coli staphylococci and pseudodiphtheria bacilli. Consequently high vaginal cultures from patients who are subjected to frequent douching show contamination with these bacteria, but in true vaginal cultures certain types of anaerobic bacilli are predominant.

Gram-positive diplococci are always present in vaginal smears. Often they are in considerable numbers but are not found in groups or chains. Streptococci are infrequent in fresh preparations but readily develop from diplococci on artificial media. Staphylococci are found in the vaginal smears but are notable chiefly for their moderate number. It is also doubtful whether bacilli of the colon group actively participate in the production of leucorrhoea. The part played by pseudodiphtheria bacilli requires further study.

**Gonococcus.** In smears made from vaginal pus the gonococcus resists positive identification. It can be differentiated from other forms only if found in considerable numbers and in typical arrangement. From its favorable locations, however it is obtained frequently enough to reveal its enormous importance as the primary cause of subsequent chronic leucorrhoea. After creating conditions favorable for the development of other organisms which are associated with chronic purulent discharge in a considerable percentage of cases the gonococcus disappears, or at least is not demonstrable through any means at our command. This suggests that a chief part played by the gonococcus in chronic leucorrhoea consists in preparing the soil for the leucorrhoea producing anaerobic bacteria.

#### TREATMENT INTRODUCTORY

As preliminary to the subject of treatment, some features of importance in the foregoing may be summarized for sake of emphasis.

1. The uterine cavity tends to remain free from bacteria in cases of leucorrhoeal infection.
2. Excessive mucus secreted from the cervix not only increases the total amount of

vaginal discharge but at the same time is culture material for bacteria which produce purulent discharges.

3. The usual seat of formation of purulent discharges is the lower genital tract (lower cervix, vagina, and vulva).

4. In the vast majority of cases the picture is one of decreased local vitality with associated low-grade infection. The organisms present are chiefly anaerobes, notably anaerobic bacilli. Often aided by increased mucous secretion, these apparently mildly virulent bacteria lodge and develop. There is reason to believe that they play an active part in the production and maintenance of leucorrhoea, until through treatment or increased local resistance their further growth is prevented.

#### INDICATIONS FOR TREATMENT

Indications formulated from a study of the causes and of the bacteriology of leucorrhoea, aided by experience with treatment of various kinds, are as follows:

1. Improvement of the lowered resistance of the genitalia.
2. Avoidance of treatment which is not indicated and which may do harm.
3. Arrest of excessive mucous secretion from the cervix.
4. Treatment directed against residual gonococci or lesions resultant from gonorrhoea.
5. Employment of special curative measures: i. e. vaccines, powder treatment, etc.

**Improvement of lowered resistance of the genitalia.** Assuming we have to do with a loss of local balance, with vitality not sufficient to cope with weakly pathogenic bacteria, detailed attention to causes of lowered resistance is indicated. Systemic disorders require watchfulness; the bowels must be free complicating displacements, tumors, pus tubes, and the like must be cared for.

Lacerations incident to childbirth are particularly objectionable; gaping of the vulva invites contamination; congestion of torn tissues promotes the transudation of serum in which bacteria may develop and in folds of relaxed mucous membrane secretions accumulate and form pockets of purulent material. These lesions may be of such a



Fig 1

Fig 1. Döderlein bacilli in mucus from normal vagina. A usual picture in mucus from non infected vulvovaginitis.

Fig 2. Leucorrhoeal discharge, gram stain. Gram-positive diplococci are usually about as numerous as seen

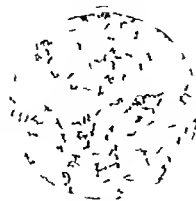


Fig 2



Fig 3

here. Note preponderance of gram-negative (lightly stained) over gram-positive bacilli.

Fig 3. Culture of bacillus of lactis acid group in symbiosis with gram-negative fusiform bacilli. Used for vaccine with good result. Carbogelatin violet.

character that a plastic operation is needed before recovery can occur.

#### AVOIDANCE OF TREATMENT WHICH IS NOT INDICATED

*Treatment of the uterine cavity.* Granted that the uterus is commonly free from bacteria, as seems true from my experience, treatment of the uterine cavity is not indicated. If infection of the endometrium does exist, harrowing the soil through use of the curette may tend to increase rather than diminish infection. In such cases we would oppose anything more than dilatation for drainage possibly aided by iodine or other topical applications.

*Douches.* The use of douches appears to be ill advised. Just as irrigation of the peritoneal cavity and of other infected surfaces has been found to be irrational, so douches scatter bacteria broadcast and fail to thoroughly remove the source of infection. In my experience douches have yielded poor results.

*Tampons.* These require only passing mention, as they have been quite generally discontinued. There seems little more indication for vaginal tampons than for the use of glycerine whiffol soaked cotton packing in deep wounds of the body surface.

*Excessive mucous secretion from the cervix.* Mucus plays a big rôle in leucorrhoea pro-

duction when it is present in excess the cervix requires attention. Operation with excision of excessive glandular tissue would be the method of choice did it not require anaesthesia. Scarification, advocated by Hunner may be employed. The use of powder will be mentioned later. Repeated cauterization with 20 per cent silver nitrate destroys mucous glands, gradually enlarges the cervical canal and is excellent for destruction of deep-lying gonococci. This has been employed in a number of extreme cases with gratifying results.

#### TREATMENT DIRECTED AGAINST RESIDUAL GONOCOCCI OR SPECIAL TISSUE CHANGES RESULTANT FROM GONORRHOEA

Deeply buried infection of the urethra and granulations of the urethra react favorably to applications of silver nitrate. Long-standing infection of Skene's ducts or of the peri-urethral glands may be treated by cauterization with 20 per cent silver nitrate. Recourse to excision may be had as a last resort. Chronically infected Bartholinian glands require removal. Treatment of the cervix is similar to that for excessive mucous secretion.

#### VACCINE THERAPY

The views of many leaders in medical thought are at variance concerning the value of vaccine therapy even in infections with a

single organism. This is an indication of the difficulties met with in formulating conclusions concerning the value of vaccines when many bacteria are present. To avoid bias in favor of bacterial therapy from results in cases which might have recovered spontaneously vaccines have been used only in long standing cases with free discharge.

*Variety of vaccines used.* Fresh smears are examined to ascertain whether any organism is predominant. Such being the case that organism has been selected. Unusual forms, when prevalent have likewise been grown for vaccine. Because streptococci are known to play an essential part in infectious processes, these have been employed for vaccines when streptococcus colonies have been numerous in cultures.

Anaerobic cultures yield an elevated rough by beaded rich growth, whereas control aerobic cultures commonly develop poorly in comparison. Large numbers of anaerobic tubes have been inoculated directly from the patient the series opened at the time of well developed growth, and those selected for vaccine which most nearly correspond with the vaginal flora as seen in fresh discharge. The slow development of many anaerobes suggested the advisability of use of mature cultures as well as of younger growths vaccines have, therefore also been made from growths three or more days old.

Sometimes from one or two original anaerobic cultures a set of subcultures has been made for vaccines. With this subculture method there is a tendency to overgrowth of types originally not numerous with disappearance of many bacteria which are abundant in vaginal smears. Hence there is objection to this technique.

*Administration of vaccines.* Despite the low virulence of these bacteria demonstrated by injection of animals with fresh discharges and with cultures it has been deemed best to begin with moderate doses. An initial injection of 10 or 20 millions is succeeded every second or third day by rapidly increased doses, until 50 to 300 millions are given at one time. Thereafter treatment occurs every fourth to sixth day with the amount increased or diminished as indicated.

*Results.* Many patients apparently cured suffer from recurrence at a later date. An instance of this is shown by a patient who, for six years, had undergone, without improvement, every known treatment for a very profuse creamy discharge. A course of vaccines resulted in complete cessation of leucorrhoeal flow. Treatments were discontinued and conditions remained satisfactory for two months. Discharge then slowly returned and became gradually more profuse despite renewed use of vaccines, which thereafter were without favorable influence.

A considerable number have shown decided decrease in discharge while under treatment without attainment of the point of absolute cure. With cessation of treatment such patients tend to gradually return to their original condition a few are permanently improved.

A fair percentage of patients are cured. A statement of the number of cures thus far obtained is omitted because experience leads us to believe that our present statistics indicate more favorable results than we will be able to secure with a larger series of cases.

A most encouraging feature has been the relief of backache and general *malaise*. Backache, which is a most frequent symptom, when not attributable to other causes is greatly relieved through vaccine treatment. The temporary increase in distress after rather large injections, also the return of backache sometimes with cessation of vaccines, indicates an intimate causal relationship between discharge and backache, and allays the suspicion that cure is attributable to psychic influences.

Vaccines prepared from selected anaerobic cultures have had the most favorable influence upon discharges. Anaerobic streptococcus vaccination was followed by disappearance of diplococci in only one case. Staphylococci caused no improvement. An autogenous vaccine prepared from a bacillus of the lactic acid group combined with a gram negative fusiform bacillus (Fig. 3) helped one case. Other isolated strains produced no noteworthy results.

As an aid to vaccines, dry cleansing of the vagina and vulva has been used considerably.

Some most refractory cases have been swabbed with iodine and treated with suppositories containing various remedial agents.

**Powder Treatment** Powder treatment of various kinds, employed by Abraham, Albert, Kehler, Liepmann, Nassauer and many others with reputed excellent results has been given a thorough trial. That no essential detail might be overlooked, freshly prepared packages were secured direct from the manufacturers who supply the advocates of this method. Patients have been most punctual in appearing for treatment and applications have been made with especial care.

The various powder and yeast preparations which are recommended in the literature include the following:

1. Sterilized aluminum acetate powder
2. Aluminum acetate 1 part  
Kaolin 3 parts  
Powdered talcum 3 parts
3. Lencet bolus with peroxide—  
Peroxide, 5 per cent  
Polymerized aluminum acetate 50 per cent  
White aluminum acetate 75 per cent
4. Same as (3) with silver acetate instead of peroxide
5. Same as (3) with 1 per cent iodine instead of peroxide
6. Injection of 10 to 20 cc. thick fluid made from solution of brewer's yeast. Repeat every 10 or three days using tampon to retain solution.
7. Yeast powder. Compound of—  
( ) Dried upper ferment beer yeast  
( ) Sugar  
( ) Aluminum acetate  
( ) Salts of magnesium sulphate, sodium phosphate, sodium carbonate, calcium carbonate
8. Sterile compressed yeast  
4 grams sterile yeast plus 20 cc. sugar solution injected vaginally and held with tampon
9. Tryon powder. An aromatic organic iodine preparation soluble powder. Used 1 to 20 per cent concentration in powder mixture or incorporated in gauze
10. Fermentin vaginal tablets in packages of twelve each gram. Retain with tampon 12 to 16 hours

At the time of treatment the cervix and vagina have been exposed and carefully dry cleaned. Enough powder to form a thorough yet thin coating (one dram or more) has then been introduced and painstakingly applied

throughout. Early cases were given a douche at the end of twenty-four hours, but it has been found more satisfactory to remove the powder through dry cleansing. Treatment is ordinarily given every day for a few days, then every second day and thereafter at still less frequent intervals. Variations in the method of procedure are required according to the needs of individual cases.

Temporary improvement has been the rule. During the course of treatment irritation and inflammation have disappeared, secretion has been absorbed by the powder, the patients have felt well. Erosions heal with the cessation of vaginal secretion and thereby mucus is decreased.

Yet despite the favorable outlook, even with treatment extended beyond the prescribed period there is a tendency to recurrence. Acute cases are started on the high-road to recovery. Through temporary relief from irritation even some that are chronic go on to cure, but a great proportion slip back into their original condition. This is true despite the addition of yeast, silver nitrate, peroxide or other ingredients.

#### DEDUCTIONS

1. Care of the general health, free elimination and treatment of pelvic complications which predispose to mild local infection must not be overlooked in the care of chronic leucorrhoea.

2. Bacteriological examinations indicate that treatment of the endometrium can ordinarily be dispensed with. In unusual cases dilatation for drainage, possibly aided by topical applications is logical treatment.

3. Curettement of the uterine cavity, douches, and tampons are probably harmful.

4. Glands of the cervix which produce excessive mucous secretion should be excised, destroyed by cautery or otherwise rendered inactive.

5. Purulent discharges originate as a rule in the lower genital tract. Bacteria of low pathogenicity chiefly anaerobes, evidently play an active part in their production.

Autogenous vaccines decrease general malaise and backache. When aided by correction of associated pathology their influence

upon chronic purulent discharges is beneficial a large number of patients are helped only so long as vaccines continue to be administered a smaller number are permanently improved, and a fair percentage appear to be cured.

6. Powder treatment exerts a favorable influence but in our experience has a limited value only. Yeast seems not to have distinct advantages over other forms of powder treatment. The medicinal effects of ingredients of the powder are probably secondary to benefits from its absorptive action. Irritating discharges are absorbed by the powder whereby the tissues are given opportunity to regain their normal resistance. If the tissues are incapable of return to normal while kept dry through use of powder recurrence of discharge may be expected with discontinuance of treatment.

7. Specific treatment that produces for us the highest percentage of successful results consists in the continued use of autogenous vaccines and dry cleansing of the vagina, together with applications of powder. Local treatments with iodine or other drugs are possible sources of help.

In the future good may come through X ray, radium, or specific drug therapy. There will doubtless always remain uncured a considerable percentage of cases in which systemic disturbances or local lack of resistance are so pronounced that no form of treatment can overcome the local infection and discharge.

Many thanks are due Dr. Thomas J. Watkins for material furnished and for constant and helpful interest shown throughout the course of this work.

## INTESTINAL POLYPOSIS WITH REPORT OF CASE WITH THREE INTUSSUSCEPTIONS

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IN presenting this article the writer desires to call attention to a class of tumors in the gastro-intestinal tract which manifest themselves in various ways and are interesting from several standpoints.

This class of tumors are of importance clinically for the relation they bear to (a) intussusception and (b) secondary changes in the tumors with marked tendency to malignant degeneration. The scarcity of American literature in contrast to the volume of English and European publications would suggest that this condition is more common in European countries and may throw some light on the etiology. There is no clear cut definition of the boundaries of so called "intestinal polyposis" or "intestinal polyposis adenomatosa." Whether the numerous reported cases of single polypoid showing hyperplasia of typical cells occurring in the gastro intestinal tract belong to the symptom complex of intestinal polyposis or not, the writer is not prepared to say. It strikes the

writer that the term "gastro intestinal polyposis" would define more correctly this condition in its various phases. Structurally the growths in the numerous cases of so called gastric polyposis are identical with those found in the intestine. Furthermore, several cases are reported under the head of intestinal polyposis where multiple polypoid were found in the stomach, jejunum and ileum as in Petrow's (1) case.

Meculengracht (2) reports two cases of multiple polypoid found in the stomach which he calls gastritis polyposa. These polyps differ in no way structurally from the tumors described by Verze (3) in his extensive monograph quoting 106 references. There seems to be some confusion in the definition of the word polyp. Wade (4) describes a case of intussusception of the stomach into the duodenum due to gastric polyp, which on further description he defines as fibromyoma. Fenger (5) in his article on benign tumors of the ileum quotes a bibliography dealing largely with polyposis.

There is also a great deal of confusion regarding the dividing line between the term polyp and adenoma, so that Hauser (6) in describing this condition uses the term "polyposis intestinalis adenomatosa." Verse admits the difficulty or impossibility of drawing a sharp dividing line between the polyps and adenoma. Adami (7) speaks of polypoid tumors of the small intestine having the general structure of adenomata. Hertzler in his recent work on tumors speaks of the intestinal polyp as hyperplasia of the mucous membrane. Kaufmann (8) in discussing tumors of the intestine speaks of the adenomata as polypoid and papillary varying within wide limits in size and distributed along the whole gastro intestinal tract. Murphy (9) reviews the article by Kassemeyer (10) who reports 224 cases of intussusception caused by tumors of which 116 were benign and of the benign he found polyps and adenomata 73 times.

The important side of the question clinically in dealing with mechanical obstruction of the bowel due to a polyp or adenoma is how far we should go in determining the existence of more tumors that may cause subsequent obstruction. Watts (11) describes a case operated upon four different times for intussusception the intussusception at each operation being caused by what Watts calls polypoid adenomata. Hartmann (12) describes a case with symptoms of pyloric stenosis where a double intussusception was found in the small intestine with multiple tumors which he describes as adenomata. Kerejan (13) reports a case of intussusception which had several attacks and at operation five incisions were made in the intestine to remove polypoid tumors which Stoerck describes as having all the elements of normal mucous membrane. There are numerous reported cases of intussusception due to single polyp or adenoma. It would be interesting to follow up a large number of such cases with reference to (a) subsequent intussusception and (b) malignant changes. I remember one day at an autopsy in a well known laboratory where the pathologist was happy in having demonstrated a primary carcinoma of the liver and in the midst of his rejoicing

a clinical assistant appeared and recognized the case as the same from which he had one year previously removed a rectal polyp.

The etiology of this condition is not clear. Some writers on the subject whose observations are confined to post mortem work believe that some diffuse inflammatory condition is a factor. The observations of numerous others do not bear this out.

The symptoms of intestinal polyposis vary within wide limits. Rectal polypi often produce marked tenesmus and bleeding and are easily discovered. Multiple tumors higher up may cause cachexia due to ulceration and hemorrhage and may be considered as a probability in obscure abdominal conditions. In some cases small polypi have sloughed and have been found in the stools. This fact is worthy of bearing in mind in cases with history of colics with obscure etiology. The history of repeated attacks of colic with symptoms pointing to obstruction, as illustrated by reported cases should suggest polyposis in obscure cases. That intussusception caused by intestinal tumor may result in spontaneous healing is shown by Hatfield (14). Analysis of the reported cases suggests that there is a type of recurring intussusception which reduces spontaneously. Our case supports this view as the history of her previous and recurring attacks corresponds closely to the attack she had on admission to the hospital when the left sided tumor disappeared with temporary relief of symptoms. Kassemeyer's study shows that intussusception plays the principal part in the symptomatology.

The common type of polyp that we recognize clinically is found in the rectum. A large number of the rectal polypi show more or less inflammatory changes and not so much of the adenoma type. The greater part of the cases on record were not discovered until autopsy and it is probable that many cases present no symptoms until obstruction results or malignant and metastatic processes develop. The great tendency of rectal polypi to carcinomatous degeneration is shown by Rotter (15) who collected 50 cases of rectal polypi with carcinomatous degeneration in 31. How this ratio compares with other gastro intestinal polyps we can not state.

Regarding location the ileocecal region leads in frequency of attack

**Treatment** On account of the wide distribution along the gastro intestinal tract and the great variation in number from one (if a single polyp can be classed with polyposis) to several hundreds, the treatment must necessarily vary with the individual case. The mortality is large in the operated cases, practically that of neglected cases of intussusception. Whether resection shall be made or the individual tumor groups ablated must be determined by the number and location of the tumors as well as the condition of the patient. The futility of radical excision in rectal polyps by some Kraske type of operation is shown by Brentano (16) as in adopting a similar procedure we are not assured of the absence of polypi higher up in the intestine. The tendency to malignant changes in the multiple polyps especially of the rectum, is accepted. Tuttle (17) states that single polypi do not undergo malignant degeneration. Mayo (18) and others have reported cases of single polypi with malignant degeneration.

**Case report** Blanche J. admitted to the Warren Hospital July 30, 93 age 16. Family history negative. The fourth child in a large, healthy family. Had measles 14 years ago. Otherwise well until year 90. Has never menstruated. One year ago had an attack of severe colicky pain in lower abdomen and over sacrum lasting about twenty-four hours. Vomited very profusely several times during this attack. Had four or five similar attacks at intervals of about a month and her symptoms were attributed to beginning menstruation. During the last six months, similar attacks have been increasing in frequency, severity and obstipation and last from two to four days. Has omitted constantly the last three days. Constipated for the past year.

**Present condition.** Fairly well developed young girl. Poorly nourished. Tongue heavily coated. Looks ill. Lungs and heart normal. Hemoglobin 75 per cent. Urine contains pos.-cells, no albumen or sugar. Pulse 90. Temperature 100°. Abdomen somewhat distended and sausage-shaped swelling is felt above left Poupart's ligament. This swelling is quite freely movable. Rectal examination negative. Patient omits frequently large amounts of greenish thick fluid. After enema, profuse foul-smelling bowel movement with disappearance of tumor.

July 31st. Patient feeling better. Free from pain. A tumor felt. Has taken some liquid nourishment.

August 1st. During the night patient taken with severe pain and profuse vomiting. A hard mass can be felt above Poupart's ligament on the left and. Repeated enemata without effect. Pulse

Temperature 100°. Some form of intussusception being suspected, operation was advised and accepted.

**Transverse incision.** Some straw-colored fluid in abdominal cavity and mass felt in lower abdomen which was easily delivered and found to consist of an invagination of the upper end of the sigmoid. This was easily reduced. After reducing, two masses were felt in the bowel in the location corresponding to the apex of the invagination. Attempting to milk these masses along produced an invagination of the bowel wall. The serosa was somewhat red, dense and not infiltrated. Bowel incised opposite mesosigmoid and two grayish spongy tumors, globular in shape and about 4 cm. in diameter were found which were attached to mucosa by two thick pedicles. The tumors were cut away and wound in mucosa sutured with catgut. Bowel closed with through and through sutures of catgut and lumen sutured of the serosa. Patient recovered nicely and was just to be discharged August 7th when she was again taken with vomiting and severe colicky pains. At this time tumor was felt on right side freely movable. An enema with free stools relieved the pain and vomiting and tumor disappeared. Was doing nicely until August 20th when symptoms returned and at this time enemata failed to relieve the condition. At this time the true condition present was suspected. Operation was advised and accepted.

By transverse incision just below umbilicus the following condition was found. An invagination of the ileum and caecal coil into the ascending colon formed tumor about nine inches long. This as reduced and tumor mass, similar to the one found at the former operation, about nine inches above the ileocecal mass was felt. This time thorough examination of the entire gastro-intestinal tract was made. Beginning at the lower end of the sigmoid, the entire colon was examined with negative results. The site of the former incision at the sigmoid could not be located. About twelve inches above the tumor-mass in the lower end of the ileum another mass was felt. High up in the abdomen on the left side another hard mass was discovered which on delivery proved to be an invagination of the ileum into the ileum making a tumor about six inches long. An interesting phenomenon was noticed here. The invaginated portion was blanched and anemic, apparently in tetanic contraction and the invaginating end above the point where the free bowel entered the invagination would alternately relax and contract, becoming rigid and anemic. This was also reduced without much difficulty and mass was felt here at point corresponding to the apex of the invagination. On examining the rest of the intestinal tract including the stomach, no more tumors could be palpated.

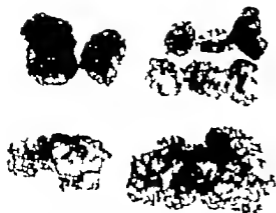


Fig. 3. The four groups of polyps removed from the following locations: Group 1, sigmoid; Group 2, above Rectoanal valve; Group 3, higher; Group 4, upper ileum.

Now the problem was how to deal with these three groups of tumors felt in the lumen of the bowel at such distances apart that they could not be removed by one resection. On account of the patient's poor condition and the ease with which the tumors were removed during the first operation, we decided to remove the tumors by incision into the intestine and cutting them off from the mucous membrane as done in the first operation. This was accomplished with little or no difficulty except with the middle group where there were four small tumors with no pedicle and part of the entire thickness of the bowel wall had to be resected and closed after the Munsell method. Patient reacted nicely from the operation and was discharged from the hospital September 6th feeling well.



Fig. 4. Cut surface of polyps from Groups 3 and 4.

Word received later from patient states that she is in perfect health and has gained twenty pounds in weight.

Pathological report by Professor H. E. Robertson, University of Minnesota.

#### MULTIPLE INTESTINAL POLYPS

The specimens consist of four groups of polypoid tumor masses. Group No. 1 was removed from the mucous membrane of the sigmoid and is composed of four irregularly lobulated, roughly rounded polypoid masses, each measuring about 3 cm in diameter. The surface of each is composed of several nodular lobes separated by deep clefts, which in turn are made up of tiny lobules, cragging about 1 mm across and producing a slight bossed or hobnail appearance. Slimy, mucoid like substance bathes the surface, which is dotted by grayish-white opaque spots on the semitranslucent colloid appearing ground substance. On section the lobes



Fig. 5. Microphotograph showing section of folded type of polyp growth. Not remarkable to normal mucous membrane. Magn. 6X.



Fig. 6. Microphotograph. Section of papillary type of polyp. The irregular branching character of the trabeculae is characteristic of the larger number of the polyps found in this case. Magn. 6X.

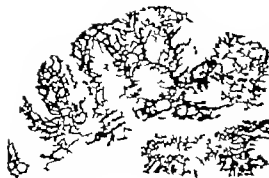


Fig. 5 Microphotograph. Section of branching in choroidal polyp. The connective tissue framework is more delicate than in Fig. 4. Magn. 6x.

has a radial arrangement of substance with large central blood vessels and fairly soft pulp of semitranslucent, grayish white color with intervening bands of moderately dense connective tissue. The cut surface of the stipe (attachment or pedicle) of each polyp does not measure over 1 cm in diameter.

Group N<sub>2</sub>, removed from the mucous membrane of the ileum at point about 30 cm above the ileocecal valve, consists of 1 mass, the larger measuring about 3 cm in diameter and having surface which is thrown into irregular folds rather than lobes and pedicle measuring 3 cm in thickness and 1 cm in length. Otherwise, it resembles those of Group N<sub>1</sub>. The second mass measures 1 cm in diameter and represents single lobe or nodule similar to those described in Group N<sub>1</sub>.

Group N<sub>3</sub>, removed from ileum at point 46 cm above ileocecal junction, consists of about six masses, five



Figs. 6, 7, 8, 9 Microphotographs showing appearance of epithelium and stroma in various portions of the polyps. Much of the stroma shows inflammatory infiltration of cells. The cells are predominantly small and round. Magn. 30x to 100x.

resembling in size and shape and appearance the smaller one of Group N<sub>1</sub> and one composed of folded mass resembling compact thickened synovium and measuring 3 cm in length and 1 cm in height and 1 cm in breadth.

Group N<sub>4</sub>, removed from ileum at point about 64 cm above ileocecal junction and is made up of two masses one measuring 3.5 cm and having two lobes the other single lobe 1 cm in diameter. Except for being slightly denser consistency, these resemble the tumors of Group N<sub>1</sub>.

Microscopic examination. The lobulated masses consist of arboriform network of connective tissue lined on both sides with continuous single layer of tall epithelium, resembling goblet cells in every respect. Cross section of this epithelial lined network gives the appearance of numerous irregularly



Fig. 7



Fig. 8



Fig 9

rounded acini of various sizes. Near the outer surface areas of hemorrhage are common while a thick mucoid exudate is everywhere abundant. Foci of lymphoid cells are common in the connective tissue and occasional areas show infiltration of polymorphonuclear leucocytes. The folded portions show a mass of tall, regularly dilated and branching tortuous gland ducts somewhat resembling those found in the mucosa of the ileum. Goblet-cells still predominate but the ducts are more compactly arranged and the individual cells are not so large. On the outer surface is cut inflammatory exudate and necrosis. The deeper layer of connective tissue resembles submucosa containing large blood vessels and showing many foci of lymphocytes. No smooth muscle is visible in any of the specimens.

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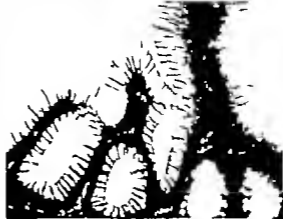


Fig. Microphotograph. High power view of characteristic goblet-cells surrounding gland ducts in their arrangement. Magn 350 X.

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## PYONEPHROSIS

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MY reason for selecting that condition known as *pyonephrosis* as the subject of this communication is not only because of its importance as a lesion by itself which is a terminal one but on account of the varied causative conditions that lead up to that of *pyonephrosis*.

*Bacterial inflammation of the kidney* may begin in the pelvis or the medulla and when suppurative nephritis terminates in diffuse destruction by the formation of multiple abscess foci (Figs. 1 and 2) which merge into one or more cavities, we then have one or the other type of *pyonephrosis* or the condition may start as a *hydronephrosis*, and in consequence of a superadded infection, develop *pyonephrosis* with marked dilatation and little normal kidney structure remaining (Fig. 3). On the other hand, when the process begins in the kidney substance, as in *pyelonephritis* there is extensive destruction of the parenchyma and only moderate dilatation of the pelvis (Figs. 4 and 5).

To recite the various methods of bacterial infection of the kidney is to mention the causative agencies of *pyonephrosis*. Thus, cases which occur primarily in the kidney and which are lymphogenous or hematogenous in derivation are usually descending in type, such as infected *hydronephrosis*, multiple *septic infarction* and *calculus* or tubercular *pyelonephritis* (Figs. 6, 7 and 8) while those that are ascending in type are urogenous in derivation, sometimes acute, but usually chronic suppurative *pyelonephritis* or surgical kidney (Figs. 9 and 10).

The predisposing factors, therefore, in *pyonephrosis*, are

1. *Hydronephrosis* (example Fig. 3)
2. Previous morbid lesions of the pelvis: *pyelitis*, pelvic stone (example, Figs. 6, 9 and 10)
3. Previous morbid lesions of the kidney: single or multiple focal abscesses, tuberculosis (examples, Figs. 1, 2, 4, 5, 6 and 7)

The ordinary pyogenic organisms are the

invading agents in *pyonephrosis*, principally the bacillus coli, sometimes streptococci and staphylococci when suspicion is directed toward a hematogenous infection. Gonococcal infection is infrequently the cause, although authentic cases tend to show a somewhat greater number of such than was formerly suspected.

Lenhartz, in a study of sixty cases, found the bacillus coli in fifty of them. The encapsulated pus in *pyonephrosis*, as illustrated in the accompanying pictures, is contained in several cavities (Fig. 1) which may or may not communicate or in one enormous sac (Fig. 3). The former occurs when the suppuration begins in the kidney substance the exterior presenting a lobulated appearance (Fig. 2) and the latter is an outcome of *hydronephrosis*, when on section the organ will completely collapse showing a large, thin-walled cavity. The pus is usually thick, creamy and foul of odor when due to infection by the bacillus proteus and certain strains of the bacillus coli. The association of renal calculus is very common as shown in some of the illustrated cases (Figs. 1 and 6).

Pelvic stones are likely to be primary and one of the causative factors of the condition (Fig. 6). Secondary stones are deposited at the site of abscesses of the malpighian pyramids. The superadded condition of tuberculosis may present the same appearance as without such coexistence (Figs. 4 and 7) the walls of the abscess being lined with tubercles. In *pyonephrosis*, the ureter may be normal, or may undergo an enormous dilatation, and in the so-called ascending types in which there is a double urogenous infection dilatation of the ureter may be double and the picture that of general vesico-ureterorenal distention.

In some cases, the clinical history is that of the preexistent condition, namely prolonged cystitis and pyelitis, or sudden or progressive infection of the kidney or tuberculous or pyogenic infarction. In other cases, the first

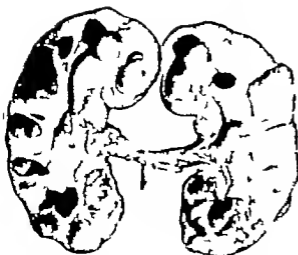


Fig. Pyonephrosis — multiple cavity

symptom may be that which brings to light the pyonephrosis.

Pain is generally dull in character and located in one or the other hypochondrium or loin. There may be only a trace of tenderness and pain on deep pressure in the loin. In the lumbar region or at the costovertebral angle. A rounded or irregular mass may be felt by bilateral pressure and the condition may exist without a palpable kidney.

The urine, on gross examination shows nothing more than is found in cystitis: a general turbidity due to the presence of pus and bacteria, but as a clinical observation it is well to bear in mind that profuse pyuria with pus equally distributed in two or three flows, without the evidence of marked vesical irritability is suspicious of pyonephrosis. The constitutional symptoms may be slight. Such is a general outline of the salient features in an open or draining pyonephrosis.

In so called closed pyonephrosis when the ureteropelvic outlet is occluded, the urinary symptoms are lacking but in this case the constitutional symptoms are in proportion to the acuteness of the inflammatory process.

A rentable connective tissue sac containing little kidney substance and nothing more than an accumulation of pus (Fig 3) may afford neither urinary evidence or constitutional symptoms of importance and the bladder urine will represent only that which



Fig. Same case as Fig. 2 — exterior view (lobulated appearance)

is derived from the uninfected kidney. A sudden closure of an open pyonephrosis is apt to be signalized by the occurrence of sharp constitutional symptoms.

From the foregoing facts it is appreciated that the diagnosis cannot be made from the clinical picture or previous history and this



Fig. 3. Pyonephrosis — single cavity (infected hydro-nephrosis)



Fig. 4. Tuberculous pyonephrosis — multiple ca. sites.

applies to pyonephrosis, as well as to the preceding condition, pyelitis.

In the Vienna General Hospital before the present methods of diagnosis with cystoscopy, radiography and pyelography were as frequently practiced in more than two thirds of 750 cases of pyelitis upon which autopsies were performed a diagnosis had not been made. Whether or not there is a palpable tumor is not conclusive on account of the possibility of other retroperitoneal growths, and the diagnosis must rest largely upon cystoscopy, ureteral catheterization and radiography.

**Cystoscopy.** In secondary or ascending cases, cystoscopy will reveal the presence of the primary lesion in the lower urinary tract.



Fig. 5. Pyonephrosis with destruction of kidney.



Fig. 6. Calculi pyonephrosis (stone in pelvis and pyonephrosis).

In primary renal infected cases, the bladder even after a long existing pyuria, may show little change.

The ureteral orifice of the affected side usually shows a gaping edema, and a block of pus is not uncommonly found extruding its way out of the opening while it is possible that the ureteroscopic picture may be far from abnormal even in advanced cases. In a personal case in which both kidneys were involved, on the one side, on which the kidney was contracted to the size of a small oyster the ureteral mouth was dilated, whereas in the opposite kidney although there existed a huge pyonephrotic sac and a dilated ureter the size of the small intestine the ureteral mouth on the bladder side was small and normal in appearance.

Catheterization of the ureter as a rule obtains on the infected side turbid whey like urine or pure pus, except in closed pyonephrosis, when no secretion whatever is obtained.

Renal radiography will reveal the presence of calculi (Figs. 1 and 12) and pyeloradiography the outlines of a rounded or lobulated tumor (Fig. 13) as shown in the cases.



Fig. 7 Tuberculous pyelonephritis



Fig. 8 Same case as Fig. 7 — exterior view (cortical abscess)



Fig. 9 Collapsed atrophic kidney showing prolapsed kidney and descended pelvis



Fig. 9 Same case Fig. 9 after operation

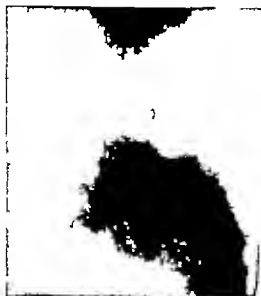


Fig. 6. Radiograph of renal calculus (same case as Fig 6, kidney removed)

The measures of *treatment* to be adopted are palliative or radical, operative and cystoscopic.

By palliative measures are meant anything short of operative interference and exposure



Fig. 7. Renal calculus—little or no kidney exposure

of the kidney. Such measures are not to be countenanced in the case of advanced kidney lesion, except where operation is rejected or where the patient's condition does not warrant such a step. In such a case drainage of a



Fig. 8. Collargol radiograph showing lobulated appearance of pyonephrotic kidney



Fig. 9. Structure of ureter and pyelonephritis (col. large picture)



Fig. 5 Chronic pyelonephritis ascending (surgical kidney right side)

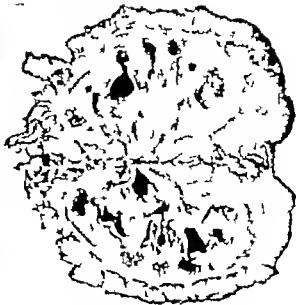


Fig. 16 Same case as Fig. 5 — opposite kidney

suppurative kidney may be effectively accomplished by the introduction from below of a ureteral catheter which is left *in situ* with or without lavage of the purulent sac. Lilienthal has reported a successful series of cases of different types. One of the cases illustrated here is an example of this means of treatment (Fig. 14).

Otherwise the measures of treatment are operative. The choice of operation lies between nephrectomy and nephrotomy — nephrotomy when there is doubt as to the functional value of the other kidney, and when there is great urgency on account of septic uræmic symptoms which do not allow time for careful study of the case. This is illustrated

in one of the cases of this series (Fig. 15) and although a fatal issue ensued the condition of the opposite kidney after death justified the conservatism of this measure as the remaining organ was useless (Fig. 16). If necessary a secondary nephrectomy may be performed later when the capacity of the other kidney has been established.

On the other hand should the functional tests and laboratory examinations show the opposite kidney to be capable of performing the required work, primary nephrectomy is usually *the operation of choice*.

With the coexistence of tuberculous infection and the integrity of the other kidney, proven nephrectomy is *the operation of necessity*.

## HEMORRHAGIC OSTEOMYELITIS

B. GEORGE BARRIE, M. D. NEW YORK CITY

WITH OBSERVATIONS ON ITS PATHOLOGY

BY O. S. HILLMAN, M. D. NEW YORK CITY

THE term hemorrhagic osteomyelitis is meant to embrace a majority of those traumatic, localized non-infective (so far as we know at present) non-suppurative low grade inflammatory lesions that have their onset in spongy bone.

The term is also used to express more exactly and correctly the lesions which at present are classified under a variety of names, more or less misleading such as medullary giant cell sarcoma, myelogenous giant-cell sarcoma, myeloma, medullary giant-cell tumor, benign bone cyst, osteitis fibrosa, traumatic solitary bone cyst, etc.

Under the single heading "hemorrhagic osteomyelitis," and its subdivision into two forms, one is able to include the different phases the chronic lesion assumes, and thus avoid the mixed terminology at present in use.

What may be called the systemic bone lesions, such as syphilis, tuberculosis, rickets and metaplastic osteomalacia are excluded (The latter term was originated by von Recklinghausen in 1910 to include his previously described disease, osteitis fibrosa, and also the non cystic form osteitis deformans of Paget). Also are excluded the lesions due to the acute infections or parasites.

The following simple classification is suggested for consideration:

## HEMORRHAGIC OSTEOMYELITIS

Traumatic Localized Non-infective (?) Non-suppurative

Acute Never observed

Chronic —

Type A hemorrhagic (shows little or no metaplastic change)

Type B fibrocystic (due to later metaplasia)

A Chronic hemorrhagic osteomyelitis —

Synonyms

- 1 Medullary giant-cell sarcoma
- 2 Myelogenous giant-cell sarcoma.
- 3 Myeloma
- 4 Medullary giant cell tumor (Bloodgood)

B Chronic fibrocystic osteomyelitis —  
Synonyms

- 1 Benign bone cyst
- 2 Osteitis fibrosa.
- 3 Chronic osteomyelitis fibrosa — cystic or solid (Bloodgood)
- 4 Traumatic solitary bone cysts (Felten and Stolzenberg)

The experiments and researches of Ullman, Warren, Felten and Stolzenberg and others have clearly demonstrated that a slight trauma is sufficient to cause fractures of the delicate normal bone trabeculae of the long bones, producing effusion, hemorrhage and interference with nutrition, thereby setting up a localized osteomyelitis. Trauma seems to be the starting point in the production of these solitary, non-infective, non-suppurative, low grade, inflammatory lesions. It is quite easy to understand that destruction of the trabeculae will have a pathologic effect on the venous sinuses that are supported by it, causing thinning of the vessel walls, which possess no muscular fibers, and their dilatation and varicosity, transudation, and possible rupture. The varicose and dilated vessels are also a constantly active factor with the aid of the forming granulation tissue in which they are enmeshed in the further rarefaction and progressive destruction of the bone from pressure necrosis.

This constitutes a localized low grade osteomyelitis. Immediate effort at repair begins with the formation of primitive hemorrhagic granulation tissue, with metaplasia, resorption, regeneration, and restoration of architectural arrangement of structures and function, and the lesion is cured or rarely becomes chronic.

The writer described in detail the etiology, symptomatology, gross pathologic picture, and histopathology, the chronic lesion presents.

The chronic lesion may remain hæmorrhagic in form (type A) or later assume fibrocytic changes (type B). Just what chemotactic properties of the blood permit one lesion to go on to fibrous metaplasia and allow the other

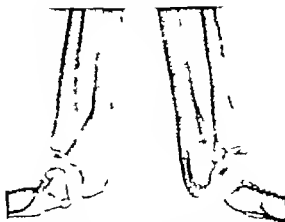


Fig. 2. Case No. 1. X ray showing normal bones on left and lesion in distal end of humerus on right.

and constant destruction of bone trabeculae from pressure necrosis, and nutritional inhibition.

Throughout the life of the lesion the granulation tissue as a rule shows no metaplastic change, but retains its general primitive hæmorrhagic type. Occasionally fibrous patches are seen in the granular mass and quite frequently hyaline thrombi.

The appearance of the gross lesion in the fresh is unlike any of the known neoplastic growths, which is one of the writer's reasons for attaching the title of medullary giant-cell sarcoma which it has heretofore quite generally borne.

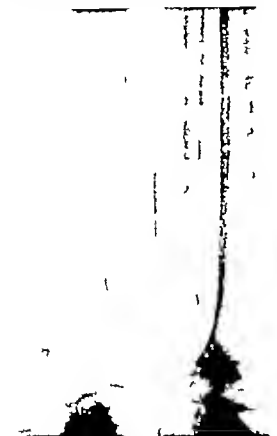


Fig. 3. Case No. 2. X ray showing lesion in lower end of tibia.

to retain its primitive hæmorrhagic form must be a subject of further study.

*Type A — Chronic hæmorrhagic osteomyelitis.* This is a low grade inflammatory process, showing progressive proliferation of highly hæmorrhagic granulation tissue, of tumor-like formation. Preceding and going hand in hand with proliferation there is steady



Fig. 4. Case No. 3. X ray showing lesion in right sacro-thacic joint.

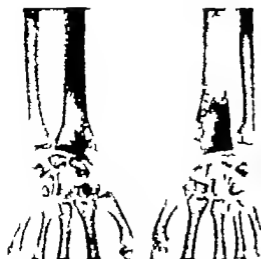


Fig 4 Case No. 4 X ray showing normal bones on left and lesion in lower end of radius on right



Fig 5 Case No. 5 X ray showing normal bones on left and small lesion in upper end of right radius



Fig 6 Case No. 6 X rays showing advanced circumscribed lesion in upper end of radius



Figs 7 and 8. Case No. 7. Photograph of patient before operation showing swelling at lower end of right thigh.

It has the typical look of hæmorrhagic, primitive, granulation tissue red in color somewhat friable and feels like jelly, is smooth and glistening oozes and has the consistency of autopsied fresh brain tissue. As early as 1848 Stanley in his treatise on diseases of the

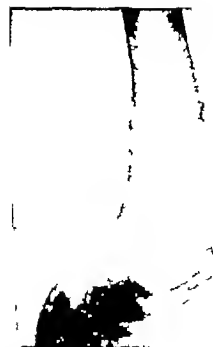


Fig. Case No. 7. X-ray (lateral view) showing lesion more advanced. Erosion of anterior surface of femur.



Fig. 9. Case No. 7. X-ray 18 months after injury and four years before operation. Early lesion in lower end of femur.

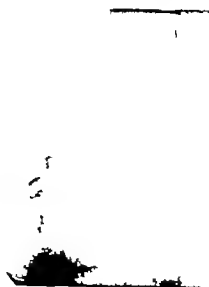


Fig. Case No. 7. X-ray (anteroposterior view) showing lesion protruding externally through erosion in the bone.



Fig. 7. The other reason for reconstruction of the mandibular joint. This line shows the extent of anastomosis resulting. There is also paralysis of the occipitofrontalis muscle.

For ankylosis directly affecting the joint, that will not yield to simple dilatation (and in few cases will dilatation be permanently effectual) an excision of the joint or the removal of a section from the body of the ramus will be necessary (Spanton once divided ear bands around the joint subcutaneously with a tenotome but the ankylosis returned).

I march operation which is the excision of a fair sized piece of the full thickness of the bone at or in front of the angle was one of the first to attract general attention and is still popular. For further historical data we note and chart at the end of the paper.

The more rational one but one more difficult of execution has been credited to Bottini and consists in the removal of the condyle or the condyle and coronoid process when both are involved often there is but a mass of bone uniting the ramus to the base of the skull.

George Murray Humphrey in 1854 excised the condyle for a diseased condition of the process that was distorting the jaw.

Excisions from or sections through any part of the ramus or body have been made but unless a considerable piece of bone is

removed or unless some material is interposed between the cut ends these may reunite. Various materials have been used for insertion between the bones—metal gutta percha rubber plate neighboring muscle tissue, or foreign animal membrane. We have always used a flap of the subcutaneous temporal fascia and believe it admirably adapted to the purpose. The method of approach has varied somewhat. For operating near the angle or on the lower part of the ramus the incision is usually made along the lower border of the jaw and the posterior part of the ramus. For approaching the neighborhood of the joint, numerous different incisions have been used. The chief essential of the incision is that it renders the joint accessible and that it does not destroy the nerve supply to the orbicularis palpebrarum. In the operation we employ we have found it impossible to preserve the nerve supply of the anterior belly of the occipitofrontalis muscle.

In general the incisions that have been employed as given by L. W. Orlow are:

- 1 Vertical incision first used by Bottini
- 2 Horizontal
- 3 Blandin's arched incision with convexity forward and downward
- 4 Alexander tongue shaped incision over the masseter muscle
- 5 Incision one part vertical in front of the ear the other parallel to the zygoma



Fig. 8. Showing the result of excision of an ankylosed joint. The oblique division of the posterior upper part of the ramus facilitates forward movement.

Dr. Archibald C. Chalmers, Jr., 1900

- 6 Humphreys upper angle incision
- 7 Abbe's lower angle incision
- 8 Hirsch and Cabot cross incision
- 9 Krause's combined arch and horizontal incision

Mears divided the ramus above the last molar from within the mouth and twisted out the upper fragment. The incision which we have employed in all of our cases differs somewhat radically from those presented elsewhere and has the advantage that it is almost completely within the hair line and allows of the making of a properly fashioned flap of fat tissue for the construction of the new joint. The skin flap with a very little subcutaneous tissue is turned downward and forward. Then a similar flap is made of the subcutaneous tissue down to the temporal fascia; this latter should contain the trunks of the temporal artery and vein uninjured. The parotid gland containing the branches of the seventh nerve and the masseter muscle are stripped downward en masse with an elevator; the site of the joint and the upper part of the ramus are exposed; the condyle coronoid, and upper part of the ramus are removed with bone biting forceps, and chisel until there is a space of three quarters of an inch between the ramus and the skull. Next the fat flap still attached at its base is sutured to the now exposed internal pterygoid muscle so that it rests between the cut portions of bone. The skin flap is sutured in place and a rubber dam drain is let out through the lower part of the wound. After cutting the bone the mouth is forced open with a specially constructed dilator. If the mouth will not yield sufficiently then the operation must be repeated on the other side. We have had but one case of double ankylosis although in one case a patient thirty five years of age who had had a complete unilateral ankylosis for fifteen years the good joint was very stiff and required careful stretching with considerable force. In another case while attempting simple dilatation we fractured the jaw at the site of an unerupted third molar and after the fracture united excised the ankylosed joint. Though it causes discomfort we prefer to dress the mouth open for a week.



FIG. 9. Shows the condition resulting from ankylosis during the growing period and the result of the operation with transplantation of cartilage into the chin. She has permanent opening of one inch & 1/2 years later.

This operation which we presented at the St. Louis Medical Society in 1910 we have employed in five cases, and the results are such that we have no inclination to modify it in any essential detail except where there is excessive recession of the chin. In the latter case the operation as described above is done on the ankylosed side and on the other a simple subcutaneous section of the ramus is done with a Gigli saw. Then the body of the jaw is drawn forcefully forward and held in this new position by wiring the lower to the upper teeth. These wires remain in place twelve weeks. Later gradual stretching of the new joint is done with rubber wedges or bottle stoppers. In two cases we have rounded out a deficient mental eminence by implanting a section of costal cartilage in the soft tissues of the chin.

**Results.** The immediate result where the mouth was dressed open was an opening of three quarters to one inch. By the use of a rubber bottle stopper this opening is preserved or even increased in the next two months. Later the opening gradually increases until it may reach one and one half inches. In a child of five years, with a double ankylosis, we were unable to get more than three quarters of an inch opening and a rubber dilator had to be used a long time to maintain this, but I believe in time this amount of opening will increase. In



FIG. 1.—Shows the conditions resulting probably from scars the jaws being bound together by scar tissue and the result of a plastic operation and transplantation of skin from the neck to replace the scar tissue on each side of the cheek.

some of the reported cases greater openings have been obtained. According to Orlow, in cases analyzed by him there have been recurrences in twelve per cent of the cases, but many operations in the past have been inadequate. If he were to include operation which consisted in simply stretching the adhesion and throwing back the number of recurrences would be much nearer to one hundred per cent.

The objects of the operation are to allow the mouth to open sufficient for function, to restore the lateral or grinding motion of the jaw, and to allow in position and cleansing of the mouth. Not the least part of the suffering of these patients is from toothache. An opening of one half inch is not sufficient for any of these purposes, but add just a little more and all of them can be carried out fairly well. A gentleman, at the age of about sixty, was sent to me because of an ankylosis that permitted an opening of eighteen thirty seconds of an inch and which caused him great annoyance. With the help of Dr. J. A. Brown, of this city, we constructed a pneumatic dilator which his dentist used intermittently for about one year and got a permanent opening of three sixteenths of an inch more. With this he is able to eat bread and butter without get-



FIG. 2.—Shows scar tissue in both sides of the cheek binding the jaws together. A double transplantation from the neck was done.

ting it all over himself (quoted from his dentist letter). This case is cited simply to show how much a slight gain on the measuring stick may really be in function.

*Wounds and Complications.* Aside from simple wound infection, the most common post-operative complication is a temporary paralysis of the whole or a part of the seventh nerve. In the incision we describe the branch to the occipitofrontalis muscle will be cut and the patient will be unable to wrinkle the forehead on that side. This has been permanent in our cases. A more general affection of the nerve has frequently resulted from stretching or from wound infection but this usually passes off in five weeks. In one case we injured some fibers of the orbicularis palpebrarum and for several months the patient was unable to close the eye completely but finally fully recovered. One operator divided the trunk of the seventh nerve and had a permanent paralysis. This would seem to be an almost unnecessary accident. In several cases tracheotomy had to be performed during the operation and several operators have done it before attempting the operation. While we



have always been prepared to do a tracheostomy we have so far not found it necessary

### CONCLUSION

It is our belief that, except in comparatively few cases, simple stretching is not a permanent nor an adequate relief for ankylosis of the jaw but that a properly performed operation will give permanent relief with minimum discomfort and with very little risk to life and great benefit to the patient.

### KEY TO REFERENCES

For the purpose of condensation the various cases are reported in abbreviated form, the numbers in each case referring to the numbers in the Key below.

- |  |                                   |
|--|-----------------------------------|
| (1) Name and reference                 | (8) Previous treatment            |
| (2) Age and sex                        | (9) Operation before operation    |
| (3) Date of operation                  | (10) Operation                    |
| (4) Duration of ankylosis              | (11) Mouth dressed open or closed |
| (5) Preceding cause                    | (12) Complications                |
| (6) Character of ankylosis             | (13) Result                       |
| (7) Pre-operative opening and movement |                                   |

CASE 1 (1) Rochet Arch prov de Chir 3 (1) M (3) July 3 804 (4) 7 yrs (5) (6) Bone left (7) 1/4 cm between incisors (8) ? (9) ? (10) Wedge of bone removed and muscle implanted (11) ? (12) None (13) Recurrence

CASE 2 (1) Rochet Arch prov de Chir 3 (1) M (3) Sept 9 805 (4) yrs (5) (6) All on chin (7) Bone left (8) 1/2 cm (9) ? (10) Atrophy of jaw (11) Bone section of ascending ramus (12) ? (13) None (14) Good.

CASE 3 (1) Rochet Arch prov de Chir 3 (1) M (3) (4) 8 mos (5) Goniothorax retractor (6) Bone left (7) 1/2 cm (8) ? (9) ? (10) Bone section muscle implanted (11) ? (12) None (13) 3 cm opening

CASE 4 (1) Hartley Ann Surg Phila 9 April (1) F (3) Jan 5 900 (4) Mar 4 1900 (5) 6 mos (6) Diphtheria and scarlet fever (7) Bilateral Bony (8) ? (9) ? (10) Bone section on right side (11) Bone section on left side (12) ? (13) None (14) Good motion

CASE 5 (1) Hartley Ann Surg Phila 10 April (1) M (3) M 17 yr (4) 4 mos (5) Fracture (6) Right bony (7) 1/4 inch (8) ? (9) ? (10) E. covered condyloid process part of 25 goss and temporal bone (11) ? (12) None (13) Open 1/4 inches

CASE 6 (1) Hartley Ann Surg Phila 9 April (1) M (3) M (4) 6 yrs (5) 10 yrs (6) Bilateral Bony (7) ? (8) ? (9) ? (10) Bone section (11) ? (12) None (13) Open inches

CASE 7 (1) W J Roe Ann Surg Phila 1003 Aug (1) M (3) Dec 90 (4) Dec 9 90 (5) yrs (6) Fracture (7) Bilateral Bony (8) ? (9) ? (10) Callus removed on right (11) Callus removed on left (12) ? (13) Temporary facial parosis (14) Open 1/4 inches

CASE 8 (1) W J Roe Ann Surg Phila 1003 Aug (1) M (3) (4) 3 yrs (5) 17 yrs (6) Bilateral Bony (7) 1 cm (8) ? (9) ? (10) Callus removed (11) ? (12) Tracheostomy (13)

CASE 9 (1) Mason by Swan Med Times Gas (1) 30 F (3) ? (4) 6 yrs (5) Scarlet Fever (6) Right Bony (7) None (8) Forced under anesthetic (9) ? (10) Bone section (11) ? (12) None (13) Good Case: (1) Spanton Lancet, Lond 188 (1) ? (2) April 880 (3) April 87 (4) ? (5) (6) Bilateral Fibrous (7) ? (8) (9) ? (10) Division of external lateral ligaments (11) Similar (12) ? (13) None (14) Recurred (15) Scar Case: (1) Spanton Lancet Lond, 188 (1) 9, F (2) Nov 870 (4) ? (5) Scarlet Fever (6) Bony (7) ? (8) ? (9) ? (10) ? (11) ? (12) None (13) Able to eat

CASE 10 (1) Sidney Jones Lancet, Lond, 804 Aug (1) 8 (3) Dec 883 (4) Jan 884 (5) (6) Injury (7) Bilateral Bony (8) ? (9) Gags and plugs (10) ? (11) Bone edges removed on right (12) Bone edges removed on left (13) ? (14) None (15) Not good (16) Open one inch

CASE 11 (1) Richard Davy Lancet, Lond 846 Sept. (1) 30, F (3) Nov 878 (4) 37 (5) Tooth abscess (6) Left Bony (7) Slight (8) ? (9) ? (10) Loose condyle (11) ? (12) None (13) Died

CASE 12 (1) Richard Davy Lancet Lond, 1884 Sept. (1) 30, F (3) Feb 870 (4) ? (5) (6) Left Bony (7) ? (8) ? (9) ? (10) Loose condyle (11) ? (12) None (13) Good

CASE 13 (1) Richard Davy Lancet, Lond 1886 Sept. (1) 47, M (3) May 885 (4) 24 mos (5) Toothache (6) Left Bony (7) Slight (8) ? (9) ? (10) Fractured condyle and neck (11) ? (12) None (13) Open 1/4 inch

CASE 14 (1) Heath Brit M J 2, 84 (1) 14, F (3) M (4) 883 (5) (6) Rheumatism (7) Left Bony (8) ? (9) ? (10) Removed condyle, neck, and part of coronoid process (11) ? (12) None (13) Satisfactory

CASE 15 (1) Heath Brit M J 2, 84 (1) 14, F (3) March 883 (4) 24 yrs (5) 17 yrs (6) Right Bony (7) None (8) ? (9) ? (10) Removed bone edge (11) ? (12) None (13) Fair

CASE 16 (1) Heath Brit M J 2, 84 (1) 10, M (3) Dec 883 (4) 8 yrs (5) Injury (6) Left Ankylosis (7) 1/4 inch (8) ? (9) ? (10) Removed part of symphysis and condyle (11) ? (12) None (13) Open 1/4 inch

CASE 17 (1) Heath Brit M J 2, 84 (1) 9, F (3) March 884 (4) ? (5) Mucous (6) Left Bony (7) 1/4 inch (8) ? (9) ? (10) Bone resection (11) ? (12) None (13) Fair

CASE 18 (1) Heath Brit M J 2, 84 (1) 6, M (3) Dec 880 (4) 5 yrs (5) Scarlet fever (6) ? (7) ? (8) ? (9) ? (10) Reversion of ramus (11) ? (12) None (13) Open 1/4 inch

CASE 19 (1) Fred Page Brit M J 2, 84 (1) 22, M (3) May 887 (4) 4 yrs (5) Mucous (6) Left Bony (7) Slight (8) Gags (9) ? (10) Removed condyle (11) ? (12) None (13) Open full extent

CASE 20 (1) Fred Page Brit M J 2, 84 (1) 9, F (3) March 880 (4) 7 yrs (5) Mucous (6) Right Bony (7) Slight (8) ? (9) ? (10) ? (11) ? (12) None (13) Normal

CASE 21 (1) Barlow Lancet, Lond 803 M J 2 (1) 5, F (3) Oct 90 (4) 3 yrs (5) Injury (6) Left Bony (7) 1/4 inch (8) ? (9) ? (10) Removed mass of bone and neck (11) ? (12) Temporary parosis (13) Open 1/4 inches

CASE 22 (1) Heath Injuries and Diseases of the Jaw (1) 27, M (3) ? (4) 4 mos later (5) 20 yrs (6) Scarlet Fever (7) Bilateral Bony (8) ? (9) ? (10) ? (11) ? (12) ? (13) ?

(g) ? ( ) Wedge of bone removed from right. ( )  
Wedge of bone removed from left ( ) ? ( ) None  
( )

Case #3. ( ) Humphrey J Am M Ave, 956 Jan  
( ) F (1) 1884 (4) yrs (5) ? (6) Right bony  
(7) ? (8) ? (9) Displaced to left ( ) Removed  
condyle ( ) ? ( ) None (10) ?

Case 16 ( ) ( ) None ( ) ( )  
( ) 1, 2 (3) Paul Swann Lancet, Lond 804, July 13  
( ) 1, 2 (3) Oct 1: 80 (4) yrs (5) Scarlet  
fever (6) Bilateral Bony (7) None (8) Operations  
in E30 and 18 (reported) (9) ? ( ) Triangular  
piece of bone removed from both sides ( ) ? ( )  
None ( ) yrs later removed

Case 27 (1) Francis Stewart Ann Surr Phila  
May March (1) 6 I (1) Sept 22, 903 (4) mor-  
(1) 5 eling and discharge (6) Right Bony (7) Com-  
plete closure (2) Sequestrum removed (9) ? ( )  
Exposure of bone from joint cavity ( ) ? ( ) Slight  
rel. of pain (circumference (a) normal)

Cur 28 ( ) Willard, DeForest Ann Surg Phila  
904, March ( ) Child (3) Oct 9, 903 (4) 5 yrs  
(1) Injury (6) Adhesions (7) None (8) (9) ?  
( ) N. Incom—steady pressure under ether ( )

( ) None ( ) Normal  
Case 30 ( ) W. eth 80 Lous M Brnc ooy, Feb  
34, M ( ) Now 9 oo (4) yrs (5) Injury  
(6) Body left (7) Complete closure (8) (9) ?  
( ) Removed section of bone M inch in width ( ) ?  
( ) None ( ) Normal

Case 30 ( ) Howard Libenthal Ann Surg Phil  
71 Aug ( ) S I (3) ? (4) S ; (5) Injury  
(6) Bilateral Bony (7) Complete Closure (8)  
( ) Section of aryepiglottic, removal of neck and condyle on  
left Nine days later right similarly treated. ( ) ( )  
None ( ) Perfect in three wks.

(6) Bony Bilateral (7) Immobilized (8) ? (9) 1/2 inch  
(10) Mass of bone attached to xyphoid and radius freed

Case 3 ( ) Rogers St Paul MI got Sept ( )  
 374 3 mos 31 ( ) ( ) 4 yrs ( ) Pneumonia ( )  
 Left Boov ( ) Less than 34 inch ( ) Force und. ether  
 ( ) ( ) Section of neck removal of syngious and V  
 shaped zone bone of skull removal of skull

Mapped piece home ( ) ? ( ) None ( ) ? Full extent  
 Cave 11. ( ) Dr Rues Illinois M J 90s April  
 ( ) M ( ) Nov 90s ( ) no ( ) 5 phobas ( )  
 Bilateral, Circutinal ( ) N movement ( ) An  
 aphatic ( ) ? ( ) Left side—resected could lead  
 process dissected out coronoid process—inserted nerv per  
 Right side—resection of condylar. ( ) ( ) None  
 ( ) Mobility fair

Case 34 ( ) M Cropper Laurel, Lond 904  
March 5 ( ) M (3) Nov 20, 903 ( ) (3)  
Littoral stomatitis (6) Left occlusal bands 7)  
Checked (7) (8)? ( ) Gag inserted bands divided  
with knife check divided here it adhered to gums

Open ( ) Foul mouth healed ( ) Open each  
Case 11 ( ) M. Fluoridum. Proc. Roy. Soc. Med.

(4) ? yrs. (5) Rheumatism (6) Bilateral Bow (7) 36 inch (8) ? (9) ? ( ) Neck of left side divided - bone removed ( ) Ascending ramus on gh. re

moved ( ) ( ) Nose (g) 9 mm another  
 Case 36 ( ) Max Flanschitz Deutsche Monatsschr  
 Zahn. ( ) 40 F (g) Sept 004 (a) ym (g)  
 Tooth extraction (b) Left bony (7) Night  
 (c) Inferior maxilla not developed ( ) Removed angle  
 and part of coronoid process. ( ) ( ) Nose 5  
 4 cm average

Case 37 ( ) M. Maudsire Bull. et mém Soc de  
Chir du Far. 9 ( ) 5, 1 (1) Feb. pos. (4) 5 yrs.  
(5) Suppuration (6) Bilateral Bony (7) None (8) ?  
(9) Retraction of chin ( ) Resection of condyle and  
coronoid process on both sides ( ) ? ( ) Facial  
Paralysis per. max. ( ) 1/2 ( ) 3/4

Paralysis for nos. (3) & (4)  
Case 35 ( ) Adenoid Bull et m<sup>e</sup>m Soc de Chir  
de Par 9 ( ) M. (3) Feb 3, 9 (3) Mar  
5 9 (4) 3 yrs (3) Fracture (6) Bilateral Bone  
(7) Nose (8) 2 (9) T right ( ) Section of myoma -  
removal of bony mass on right muscle interposed. ( )  
Section of coronoid process and interposition of muscle  
on left. (32) (3) Diffuse aneurysm. (3) Anom.

(1) Cervical Vertebrae (2) Thoracic Vertebrae (3) Lumbar Vertebrae  
 (4) Sacrum (5) Coccyx (6) Pelvis (7) Femur (8) Tibia (9) Fibula  
 (10) Humerus (11) Radius (12) Ulna (13) Carpals (14) Metacarpals  
 (15) Phalanges (16) Skull (17) Mandible (18) Hyoid Bone  
 (19) Larynx (20) Trachea (21) Esophagus (22) Stomach  
 (23) Liver (24) Gallbladder (25) Pancreas (26) Spleen  
 (27) Lung (28) Heart (29) Aorta (30) Ventricle  
 (31) Artery (32) Vein (33) Capillary (34) Nerve  
 (35) Muscle (36) Bone (37) Cartilage (38) Ligament  
 (39) Tendon (40) Joint (41) Synovium (42) Meniscus  
 (43) Disc (44) Intervertebral Foramen (45) Foramen Transversarium  
 (46) Foramen Verticillare (47) Foramen Spinale (48) Foramen Sacrale  
 (49) Foramen Sacrum (50) Foramen Sacrum Medius  
 (51) Foramen Sacrum Lateralis (52) Foramen Sacrum Inferius  
 (53) Foramen Sacrum Superiorius (54) Foramen Sacrum Inferius  
 (55) Foramen Sacrum Superiorius (56) Foramen Sacrum Inferius  
 (57) Foramen Sacrum Superiorius (58) Foramen Sacrum Inferius  
 (59) Foramen Sacrum Superiorius (60) Foramen Sacrum Inferius  
 (61) Foramen Sacrum Superiorius (62) Foramen Sacrum Inferius  
 (63) Foramen Sacrum Superiorius (64) Foramen Sacrum Inferius  
 (65) Foramen Sacrum Superiorius (66) Foramen Sacrum Inferius  
 (67) Foramen Sacrum Superiorius (68) Foramen Sacrum Inferius  
 (69) Foramen Sacrum Superiorius (70) Foramen Sacrum Inferius  
 (71) Foramen Sacrum Superiorius (72) Foramen Sacrum Inferius  
 (73) Foramen Sacrum Superiorius (74) Foramen Sacrum Inferius  
 (75) Foramen Sacrum Superiorius (76) Foramen Sacrum Inferius  
 (77) Foramen Sacrum Superiorius (78) Foramen Sacrum Inferius  
 (79) Foramen Sacrum Superiorius (80) Foramen Sacrum Inferius  
 (81) Foramen Sacrum Superiorius (82) Foramen Sacrum Inferius  
 (83) Foramen Sacrum Superiorius (84) Foramen Sacrum Inferius  
 (85) Foramen Sacrum Superiorius (86) Foramen Sacrum Inferius  
 (87) Foramen Sacrum Superiorius (88) Foramen Sacrum Inferius  
 (89) Foramen Sacrum Superiorius (90) Foramen Sacrum Inferius  
 (91) Foramen Sacrum Superiorius (92) Foramen Sacrum Inferius  
 (93) Foramen Sacrum Superiorius (94) Foramen Sacrum Inferius  
 (95) Foramen Sacrum Superiorius (96) Foramen Sacrum Inferius  
 (97) Foramen Sacrum Superiorius (98) Foramen Sacrum Inferius  
 (99) Foramen Sacrum Superiorius (100) Foramen Sacrum Inferius

CASE 40 ( ) August Brocs Bull mcd Par 9  
 ( ) I ( ) Summer 000 (4) 7 yrs (5) 1 jry  
 (6) Right Bony (7) None (8) ? (9) Keeping thru  
 ( ) Resection of joint ( ) ? ( ) None (3) Milder  
 of disease

Case 4 ( ) M Donati Goe d acted de MEd  
de Torino, ( ) p M (s) Dec 000 (4) 7 yrs  
(s) Outis Medea (6) Multital Boon (s) None (s) ?  
(s) Lower jaw protruding ( ) Left resection of coronoid  
process Four days la er removed mass on the right; one  
thick ( ) ? ( ) Giv cy anous tracheotomy (s)  
(s) end

CASE 4 ( ) F Kitten Med & hls Berl pod. ( )  
 \$ M ( ) ? (4) 24 yrs (5) Injury (6) Bilateral  
 Bony (7) cns (8) ? (9) Retreated chin. ( )  
 Bony mass removed M water sample interpreted on  
 bel ( ) ? ( ) Iured tympanum healed Hearing  
 normal ( ) cns creams

Case 4) ( ) 1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11) 12) 13) 14) 15) 16) 17) 18) 19) 20) 21) 22) 23) 24) 25) 26) 27) 28) 29) 30) 31) 32) 33) 34) 35) 36) 37) 38) 39) 40) 41) 42) 43) 44) 45) 46) 47) 48) 49) 50) 51) 52) 53) 54) 55) 56) 57) 58) 59) 60) 61) 62) 63) 64) 65) 66) 67) 68) 69) 70) 71) 72) 73) 74) 75) 76) 77) 78) 79) 80) 81) 82) 83) 84) 85) 86) 87) 88) 89) 90) 91) 92) 93) 94) 95) 96) 97) 98) 99) 100)

Case 44 ( ) Carl River Zentralid f Clair Leaping  
 108 ( ) Al (1) Nov 897 (4) 4 yrs (5)  
 1 jurg (6) Dil total Carathical (7) None (8) f  
 ( ) I served condyload process Gold plat  
 interpolated ( ) Open ( ) None ( ) Open

CASE 45 ( ) Birch Deutsche red W hawke 907  
( ) 45 I (3) Nov 905 (4) yr (3) 3 lateral  
stom ulcs. (6) ? (7) 5 mm. (8) ? (9) ( ) Ulcer  
removed, resection of coronoid process. Trans of High-  
tensile curved el defect covered with plastic flaps ( ) /  
( ) Bone. (4) 4 mm. later resect

( ) Note ( ) 4 mo later open 4 mo  
Case 46 ( ) Aort Deutsche med Wochenschr 1907  
( ) ( ) 200 (4) (5) Measles (6) L lateral  
osteolysis (7) ? ( ) ( ) ( ) Lacrimae of  
osteolysis defect covered with neck flap ( ) ( )  
Name (4) Good

CASE 7 ( ) Krone Deutsche und Wehrsch 007  
( ) (3) (4) ? 5 Gewinner (5) ? (7) run  
( ) (9) ( ) Reversion of point interpolation of  
muscular muscle ( ) ( ) None ( ) ( )

(5) (a) Bala oral. Henry (7)? (8) Double entry in of  
cond. len. (1) (11) role. Farnham operations. (1)  
(1) None (3) Permanent

CASE NO.	NAME	AGE	SEX	DATE	TIME	PLACE	REMARKS
1	John Doe	25	M	10/1/50	10:00	St. Paul	Good
2	Jane Smith	30	F	10/2/50	11:00	St. Paul	Good
3	Robert Brown	28	M	10/3/50	12:00	St. Paul	Good
4	Mary White	22	F	10/4/50	13:00	St. Paul	Good
5	James Black	35	M	10/5/50	14:00	St. Paul	Good
6	Elizabeth Green	27	F	10/6/50	15:00	St. Paul	Good
7	William Hall	32	M	10/7/50	16:00	St. Paul	Good
8	Anna King	29	F	10/8/50	17:00	St. Paul	Good
9	Charles Lee	31	M	10/9/50	18:00	St. Paul	Good
10	Patricia Scott	26	F	10/10/50	19:00	St. Paul	Good



- CASE 8 ( ) Maddisford and Iamarch Arch f  
lin Chir 87 ( ) 27 M (1) July 863 (5) Nov  
5, 868 (4) ( ) Scarlet Fever (6) Bilateral Bony  
(7) Night (8) ( ) Retracting chin ( ) E fusion  
of bone edge by Iamarch method ( ) ( ) None  
(3) 3 cm open
- CASE 8. ( ) J Wolf Verband der Berl med  
Gesells 1897 ( ) 7 M (1) Mar 6 897 (4) 6  
yrs (5) Forceps del. erv (6) Bilateral Bony (7)  
None (8) ( ) Birds Beak ( ) Coronoid process  
separated from temporal insertion Small piece removed  
( ) ( ) None (1) Open 3 cm
- CASE 83 ( ) Whitehead Brit M J 87 ( )  
Γ (4) ( ) 6 yrs (5) Scarlet Fever (6) Bilateral  
Bony (7) None (8) Lorro th. exstha (9)  
( ) Forcible fracture of condyle ( ) ( ) None  
(3) Almost normal
- CASE 84 ( ) Paul Ichnark Med Gesellschaft  
Magdeburg 863 ( ) Γ (3) July 1, 863 (4) 9 yr  
(5) I jury (6) U lateral Bony (7) None (8)  
(6) Birds beak ( ) Removed coronoid process head  
and neck ( ) ( ) None (1) Good
- CASE 85 ( ) Schulten Arch gën d Chir Par 89  
( ) 1 M (3) 877 (4) yrs (5) Osteomy (6)  
Bilateral Bony (7) (8) Both coronoid processes  
cut through (9) ( ) Section of coronoid process  
( ) ( ) None (3) Successful
- CASE 86 ( ) Riegner Deutsche med Wochenschr 906  
( ) ( ) (4) ( ) (5) (6) Bilateral Bony (7)  
(8) ( ) ( ) Hellreich operation ( ) ( )  
None (3) Γ cellum
- CASE 87 ( ) Position 893 Austral M Gw ( )  
7 Γ (3) 89 (4) yrs (5) I jury (6) Bilateral  
Bony (7) 1/2 inch (8) ( ) ( ) Removed neck  
and part of condyle ( ) ( ) Scar on left (3)  
Good movement
- CASE 88 ( ) Position 893 Austral M Gw 11  
24 1 (4) 897 (4) (5) Fever (6) Right Bony  
(7) (8) ( ) ( ) Removed neck of condyle and  
base of zygoma ( ) ( ) None (3) Free move-  
ment
- CASE 89 ( ) Rhin h L nord Lond 89 ( )  
(1) M (3) April 30 89 (4) yrs (5) I jury (6)  
Left Bony (7) ( ) (8) ( ) ( ) Removed f x  
meats from zygoma ( ) ( ) None (3) Open  
1 inch
- CASE 90 Reid Arch gën d Med 379 ( )  
(1) Aug 857 (4) (4) (6) Caustical ( )  
(3) ( ) ( ) R. resected piece of mandible ( )  
( ) None (3) Good
- CASE 9 ( ) Roaming Zentralbl f Chir 891 ( )  
(1) (3) Oct 19 890 (4) (5) Pyemia (6)  
Bilateral Bony (7) (8) (9) ( ) Bot m  
Anky method ( ) ( ) None (3) Normal
- CASE 9 ( ) Roaming Zentralbl Chir 89 ( )  
(1) Apr 7 890 (4) yr (5) Rheumism ( ) Bot m  
Anky's method ( ) ( ) None (3)  
CARE 91 ( ) Little 87 4 T N York M Soc ( )  
o. f (3) Sept 30 89 (4) 5 yrs (5) Abscess  
Right Bony (3) None (8) ( ) ( ) I fusion  
of condyle ( ) ( ) None (3) Open 1/4 inch
- CASE 94 ( ) Mays 87 7 Arch f Klin Chir  
( ) 7 M (3) July 89 (4) Nov 5 898 (4) 3 yrs  
(5) Scarlet fever (6) Bilateral Bony (7) None (8)  
(6) Retracting chin ( ) Iamarch operation on  
right ( ) Iamarch operation on left ( )  
None (3) Open 1 cm
- CASE 95 ( ) W. Grube 863 Arch f Klin Chir  
( ) 1 (3) Sept 3 86 (4) Oc 5 86
- (4) 5 yrs (5) S effing (6) Left Bony (7) None  
(8) ( ) Retracting jaw ( ) I fusion of joint and  
condyloid process removed through mouth ( ) Sub-  
cutaneous section of masseter ( ) ( ) None (3)  
Munche contracted (3) Good movement
- CASE 96 ( ) R Abbe 88 N York M J ( )  
M (1) Dec 879 (4) 7 yrs (5) Otitis Media (6)  
Left Bony (7) Night (8) Dilatation (9) Retracting  
chin ( ) Removed neck of mandible ( ) ( )  
None (3) Good
- CASE 97 ( ) Ranke 885 Arch f Klin Chir ( )  
M (3) Mar 9, 885 (4) 9 yrs (5) Suppuration  
(6) Left Bony (7) ( ) (8) ( ) ( ) Konig  
Resection ( ) ( ) None (3) Open 1.5 cm
- CASE 98 ( ) H Morestin Bull et mém Soc  
de Chir de P ( ) 8 1 (3) Jan 900 (3) Jan  
6 900 (4) 4 yrs (5) I jury (6) Bilateral Bony  
(7) None (8) ( ) Chin retracted ( ) Bony mass  
removed on right ( ) Bony mass removed on left ( )  
( ) Occasional subluxation (3) Open 1 cm
- CASE 99 ( ) M Cerna avec Bull et mém Soc de  
Chir de Par 896 ( ) 30 M (1) Dec 26 891 (4)  
6 yrs (5) Embolus (6) Right Bony Left I bones  
(7) None (8) ( ) ( ) Removal of bone on right.  
Adhesions broken on left ( ) ( ) Chloroform parot-  
omy Laryngotomy ( ) Good
- CASE 100 ( ) Feb Legras Bull et mém Soc de  
Chir de Par 903 ( ) M (3) Oct 30 (4) 3 yrs  
(5) I jury (6) Bony (7) None (8) ( ) ( ) I m  
contact ( ) Removed part of condyle ( ) ( )  
Paralysis of orbis palp. recov. erv (3) Excellent
- CASE ( ) Narcis Guarnetras Cas d'op Mésao  
907 ( ) 30 M (3) Apr 30 907 (4) 5 yrs (5)  
Typhoid (6) Right Bony (7) None (8) ( ) ( )  
( ) Removed callus ( ) ( ) Slight pressure (3)  
Good
- CASE ( ) Mario Donati Arch gën d Chir de  
Par 9 ( ) 9 M (3) Dec 9, 900 (3) Dec 3  
900 (4) 7 yrs (5) Suppuration outside (6) Bilateral  
Bony (7) None (8) ( ) Retracting chin ( )  
Resection of right condyle ( ) Removed bony mass  
from left ( ) ( ) Tracheotomy (3) Perfect
- CASE ( ) Alexander Beitr f Klin Chir Tubing  
893 ( ) 5 Γ ( ) M v 7 893 (4) 4 yrs (5)  
Fever (6) Bilateral Bony (7) None (8) ( ) ( )  
( ) Resection of both sides ( ) ( ) None (3)  
Open 1.5 cm
- CASE 104 ( ) Alexander Beitr f Klin Chir Tubing  
893 ( ) 7 F (3) June 29 893 (4) 6 yrs (5)  
Scarlet fever (6) Right Bony (7) None (8) ( ) ( )  
( ) Bone removed Muscle interposed ( ) ( )  
None (3) Open cm
- CASE 5 ( ) Alexander Beitr f Klin Chir Tubing  
893 ( ) M (1) Nov 14 897 (4) 4 yrs (5)  
Rheumatism (6) Left Bony (7) None (8) ( ) ( )  
( ) Bone removed from joint coronoid process removed  
Muscle interposed ( ) ( ) None (3) Normal
- CASE 106 ( ) Gross, Phla 1 junes and dresses  
of the jaw by Health ( ) 1 1 (3) 874 (4) ( )  
(6) (7) 5 (8) (9) ( ) Resection of condyle  
( ) ( ) None (3)
- CASE 07 ( ) Walrus Berlin Arch f Klin Chir 877  
( ) (3) 858 (4) (5) (6) Caustical (7) ( )  
(8) (9) ( ) Eschbach operation ( ) ( )  
None (3) Good
- CASE 08 ( ) Dittl Verman Arch gën d med 860.  
( ) M (3) June 5 850 (4) yrs (5) I jury  
(6) Right Bony (7) ( ) G. maxilla (9) Retracting  
chin ( ) Iamarch ( ) ( ) None (3) Good



edges shape bone ( ) ? ( ) None. (3) Can chew solids

Case 30 ( ) A. J. McCosh Ann Surg Phila 893 ( ) 25, 1 ( ) Jan 893 (4) 3 1/2 yrs (5) Sepsis (6) Bilateral Bony (7) None (8) (9) ? (10) Bone resection (1) ? ( ) None (3) Es open mouth xle

Case 40 ( ) McBurney Ann Surg, Phila 893 ( ) (3) ? (4) 1-14 yrs (5) Tubercular? (6) Bilateral Bony (7) None (8) ? (9) ? ( ) Removed coronoid processes with head and neck of lower jaw ( ) ? ( ) None (3) Open 3/4 cm

Case 14 ( ) J. R. Lusk T. Clin Soc Lond 896 ( ) 45 M (1) Aug 8, 894 (4) 5 yrs (5) Rheumatic (6) Bilateral Bony (7) None (8) (9) ? ( ) Division of necks of condyles, piece of bone removed ( ) ? ( ) None (3) Successful

Case 14 ( ) L. Poisson Rev de Chir 89 ( ) 2 F (3) Apr 89 (4) 30 yrs (5) ? (6) Bilateral Bony (7) None (8) (9) Retracting chin ( ) Section angles of jaw, edge removed from right ( ) ? ( ) None (3) Opening cm

Case 41 ( ) L. Otter Trait des Resections Paro 89 ( ) 6 F (3) Oct 1890 (4) 8 yr (5) Scarlet Fever (6) Left (7) 5 mm (8) (9) ? ( ) Re section of condyle and neck ( ) ? ( ) Temporary Facial parvess (3) Open 3 cm

Case 144 ( ) Ruzick Bologna ( ) 3 M (1) 1837 (4) 5 yrs (5) Tuberculous (6) Right Bony (7) None (8) ? (9) ? ( ) Bone section from within the mouth (4 cases similarly treated) ( ) ? ( ) None (3) Good

Case 45 ( ) W. T. Bull 1835 N York M News ( ) 14 M (3) ? (4) 4 yrs (5) Obitus Medea (6) Right Fibrous (7) ? (8) Rupture of adhesions (9) ? (10) Eversion of condyle ( ) ? ( ) None (3) Free opening

Case 146 ( ) West Dec 20, 834 N York M News ( ) 3 F (3) M y 879 (4) 881 (4) ? (5) I pury (6) Occasional (7) ? (8) (9) ? ( ) Scarri excised ( ) Eversion of body of ramus ( ) ? ( ) Much pus (3) Normal

Case 147 ( ) West Dec 20, 834 N York M News ( ) 6 M (3) 88 (4) 9 yrs (5) Injury (6) Bony? (7) None (8) Stretching (9) ( ) Piece of bone removed ( ) ? ( ) None (3) Good motion

Case 43 ( ) Farnach 860 Arch gen de Med ( ) 4 M (3) M y 4 858 (4) ? (5) Syphoid fever and gangrene (6) Left Bony (7) Slight (8) (9) ? ( ) Resection of bone at 4th molar Plastic lip operation ( ) ? ( ) None (3) Good function

Case 149 ( ) Wilms Reported by Lazzarini ( ) 8 F (3) Mar 30 858 (4) 3 yrs (5) Ulcer of mouth (6) Right Occasional (7) (8) Pressure motion, edge and incision of scars (9) ? ( ) Esamarch operation ( ) ? ( ) None (3) Open cm

Case 50 ( ) Rank 885 Arch f Klin Chir ( ) 5 M (3) ? (4) 3 yrs (5) fracture (6) Right Bony (7) num (8) ? (9) ? ( ) König's resection ( ) ? ( ) None (3) Permanent

Case 5 ( ) Rank 885 Arch f Klin Chir ( ) 6 F (3) ? (4) Parry youth (5) Osteomyelitis (6) ? (7) ? (8) (9) Retracting Chin ( ) König's operation ( ) ? ( ) None (3) Improvement

Case 52 ( ) Rank 885 Arch f Klin Chir ( ) 7 M (3) ? (4) yrs (5) I pury (6) Bilateral Bony (7) None (8) ? (9) ? ( ) Bilateral resection by Bottome ( ) ? ( ) None (3) Excellent

Case 53 ( ) Nagel Desm Göttingen 878 ( ) 2 F (3) ? (4) (5) None (6) Occasional (7) ?

(8) Removal of scar (9) ? ( ) Bone section 3/4 inches membrane interposed ( ) ? ( ) None (3) Normal

Case 54 ( ) Baum Cited by Brunck Desm Göttingen 878 ( ) 5 M (5) ? (4) 13 yrs (5) Fracture (6) Bone (7) Slight (8) ? (9) ( ) Esamarch operation ( ) ? ( ) None (3) Good

Case 55 ( ) Buck Cited by Brunck Desm Göttingen 878 ( ) ? (3) ? (4) ? (5) None (6) ? (7) ? (8) Plastic operations (9) ? ( ) Esamarch operation ( ) ? ( ) None (3) Satisfactory

Case 56 ( ) Demingway Cited by Brunck Desm Göttingen 878 ( ) 6 F (3) 860 (4) 14 1/2 yrs (5) Typhoid (6) Occasional (7) ? (8) Rashid oper (9) ? ( ) Esamarch operation ( ) ? ( ) None (3) Death

Case 57 ( ) Durham Cited by Brunck Desm Göttingen 878 ( ) 37 M (2) 87 (4) ? (5) Gangrene (6) ? (7) ? (8) Operation (9) ? ( ) Esamarch operation ( ) ? ( ) None (3) Satisfactory

Case 58 ( ) Esterie Cited by Brunck Desm Göttingen 878 ( ) 34 F (3) ? (4) ? (5) Gangrene (6) ? (7) ? (8) ? (9) ? ( ) Section of bone in front of ankylosis ( ) ? ( ) None (3) Normal

Case 59 ( ) Herriot Cited by Brunck Desm Göttingen 878 ( ) ? (3) ? (4) ? (5) Necrosis (6) ? (7) ? (8) ? (9) ? ( ) Bone section ( ) ? ( ) None (3) Good

Case 60 ( ) Bruns Cited by Verneuil Arch gen de med 860 ( ) 535 M (5) Mar 855 (4) yrs (5) Gangrene (6) Left Occasional (7) None (8) Dilatation (9) ? ( ) Wedge of bone removed ( ) ? ( ) None (3) Recurrence

Case 6 ( ) Camacho Cited by Verneuil Arch gen de med ( ) 3 I (5) 840 (4) ? (5) ? (6) ? (7) (8) (9) ? ( ) Attempt made to force opening jaw fractured ( ) ? ( ) None (3) Recurrence

Case 62 ( ) Maryjohn Gaz Hebd d med d Chir 863 ( ) ? (3) 86 (4) ? (5) Gangrene (6) Left Occasional (7) Slight (8) Dilatation (9) ? ( ) Section of bone at carotid ( ) ? ( ) Gangrene (3) Partial recurrence

Case 63 ( ) Flügner Gaz Hebd d med d Chir 863 ( ) Child (3) M y 360 (4) ? (5) ? (6) U lateral occastional (7) (8) ? (9) ? ( ) Sample section ( ) ? ( ) None (3) Recurrence

Case 64 ( ) Blaschke Gaz Hebd d med d Chir 863 ( ) ? (3) Sept 186 (4) ? (5) ? (6) Left occastional (7) ? (8) ? (9) ? ( ) Resection of bone on front ( ) ? ( ) None (3) Good at first Recurrence

Case 65 ( ) Depigne Gaz Hebd d med d Chir 863 ( ) ? (3) Apr 86 (4) ? (5) Typhoid (6) Unilateral (7) ? (8) ? (9) ? ( ) Removal of 1/4 cm of bone ( ) ? ( ) None (3) Recurrence

Case 66 ( ) Rosander Arch gen d med 890 ( ) 7 F (3) Jan 877 (4) yrs (5) Scarlatina (6) Left Bony (7) None (8) ? (9) ? ( ) Section of neck of condyle ( ) ? ( ) None (3) Permanent

Case 6 ( ) Orlov 903-3 D Zischr f Chir Leipzig ( ) M (3) Dec 899 (4) 14 yrs (5) Scarlet Fever? (6) Left Bony (7) 1/4 mm (8) (9) Chin retracted ( ) Removed 1/4 of ascending ramus ( ) ? ( ) None (3) 1/4 cm

Case 68 ( ) Orlov D Zischr f Chir Leipzig 903-3 ( ) 8 M (3) Feb 4, 900 (4) 14 yrs (5) Abscesses (6) Right Bony (7) num (8) ? (9) Displaced t right ( ) Bone section ( ) ? ( ) Facial parvess (3) Fair



Fig. 2. Case N. 7. Photograph of hardened gross specimen obtained by aspiration, showing position of lesion. Erosion of lower end of femur (right) over and near and external aspects.



Fig. 3. Case N. 7. Specimen split open showing contour and extent of lesion, erosion of posterior surface of femur with projection of mass into popliteal space. Shell of internal condyle still mass in contact. Split band of tibia seen below.

bones fairly well described the lesion in the fresh as having the appearance of splenic pulp.

One of the purposes of this paper is to suggest the term "chronic fibrocystic osteomyelitis" for those solitary intra osseous lesions in bone that begin as a localized, hemorrhagic, probably non-infective traumatic process, but later take on metaplastic changes, fibrocystic in character. The term "fibrocystic osteomyelitis" defines more clearly and exactly the nature of the existing condition than the later stages of the lesions present, than those now in use, such as benign bone cyst, osteitis fibrosa, traumatic solitary bone cyst, etc.

**Type B—Chronic fibrocystic osteomyelitis.** This is a secondary stage of the hemorrhagic type due to metaplasia the granulation tissue being converted into replacement or prolifera-

tive fibrous structure. The more active the metaplastic reaction the greater the tissue retraction and likelihood of cyst formation. It is the writer's observation that cystic areas are always present in the so called solid lesion.

It is also an observation that the nearer the lesion is to the end of the long bone the greater the probability of its retaining the hemorrhagic granulation tissue type metaplasia infrequently resulting. The blood supply in the ends of the long bones is much greater than in the shaft. Just what connection this may have as a factor is to be determined. On the other hand metaplasia is more frequent with lesions some distance from the end of the bone.

It has been the contention of the writer for a long time that the lesion generally described as medullary giant cell sarcoma, myelogenous giant-cell sarcoma, myeloma and medullary giant cell tumor occurring in the ends of the long bones is wrongly classified and the terms used are misnomers.

The lesion is not a sarcoma, neoplasm or

Slight (8) (9) Retracting chin ( ) Resection of edge shaped piece from ascending ramus ( ) ( ) Hemorrhage Temporary facial paralysis (3) Good Child died few weeks later from convulsions

CASE 94 ( ) F. Bryant Russ and Rundcha 908 ( ) 3, M (3) June 30, 1907 (4) 8 yrs (5) Scarlet fever followed by mastoiditis (6) Left osseous (7) 3/4 cm bet ear and jaw (8) ? (9) Left side of chin much retracted, displaced back and ( ) Fusion of cm bone from ascending ramus ( ) ( ) None (3) Good 3 cm opening

CASE 95 ( ) Ansoor West Lond N J 902 ( ) 16 I (3) Jan 1905 (4) From infancy (5) ? (6) Bilateral osseous (7) None (8) (9) Lack of development of horizontal ramus ( ) Cut through symphysis in front of and behind tubercles and neck of jaw ( ) ? ( ) None (3) Good

CASE 96 ( ) Bogoya Ierski Khirug Moscow 9 ( ) M (3) Feb 24, 1909 (4) Since childhood (5) Inflammation of jaw with discharge of sequestra (6) Not given (7) None (8) None (9) Bird beak appearance ( ) Resection of piece of asc ramus cm long, first on one side and little later on another 1/2 transposition of flap of buccinator muscle ( ) ( )

None (3) After op on first side opening of cm after second op opening of 4 cm Appearance much improved Chin less retracting

CASE 97 ( ) Mital onis Vrach Gaz St Petersburg ( ) 5 M (3) June 5, 1907 (4) 3 (5) Scar let fever Bilateral osteo media (6) Bilateral (7) Horrible stretching (8) None (9) Lower jaw and chin poorly developed ( ) Section of ascending ramus 1/2 junction of upper and middle third transverse muscle interposed ( ) ( ) None (3) Opening of 3 cm Horizontal and vertical movement Birds beak appearance less marked

CASE 98 ( ) Dr Francis Reeder St Louis U published ( ) 16 F (3) (4) 7 mos (5) Noma following typhoid fever (6) Bilateral (7) None (8) Jaw locked (9) ( ) Skin flap from neck introduced into the mouth and attached to buccal set ( ) ( ) None (3) yrs after operation able to open 3 1/2 in normal extent

CASE 99 ( ) Dr Francis Reeder St Louis U published ( ) 4 M (3) ? (4) ? (5) Compound fracture of lower jaw followed by infection (6) ? (7) ? (8) (9) ? (a) Similar operation ( ) ? ( ) None (3) Excellent

CASE 69 ( ) Orlov D Zisch f Char Leips 902-3  
( ) 9, M (3) Nov 27 900 (4) 8 yrs (5) Gangrene,  
(6) Left Bony (7) cm (8) (9) Displaced to left  
( ) Removed 1/4 cm of bone Inserted aluminum  
plate ( ) ( ) Facial pueria, recovery (3) Open  
leg 1/4 cm

CASE 70 ( ) Orlov D Zisch f Char Leips 902-3  
( ) 3 M (3) Dec 3, 1900 (4) 30 yrs (5) Injury  
(6) Bilateral Bony (7) 3-4 cm (8) ? (9) Displaced  
to right ( ) Removed pieces of bone ( ) ( )  
Facial pueria (12) Opening 3 cm

CASE 71 ( ) Orlov D Zisch f Char Leips 902-3  
( ) 30 M (3) Oct 9, 901 (4) 4 yrs (5)  
Varicella (6) Left Bony (7) 3 cm (8) ? (9) Dis-  
placed to left ( ) Bone resected Gold plate implanted  
( ) ( ) Facial pueria (3) Fair

CASE 72 ( ) Orlov D Zisch f Char Leips 902-3  
( ) 3 M (3) Nov 90 (4) yrs (5)  
1 yr (6) Left Bony (7) mm (8) ? (9) Retracted  
to left ( ) Bone resected metal plate implanted ( )  
( ) None (3) ?

CASE 73 ( ) Schreiner Cited by Orlov ( ) 1  
(3) 804 (4) ? (5) ? (6) Bilateral Bony (7) ?  
(8) ? (9) ? Bone resection ( ) ( ) None  
(3) Good function

CASE 74 ( ) Reichen Cited by Orlov ( ) 4 M  
(3) 89 (4) ? (5) ? (6) Bilateral Fibrous (7)  
(8) ? (9) ? Retracted torusoid processes ( )  
( ) None (3) ?

CASE 75 ( ) Rowe Cited by Orlov ( ) (1)  
(4) ? (5) Congenital (6) Bilateral Bony (7) (8) ?  
(9) ? Retracted condyloid processes ( ) ? ( )  
None (3) ?

CASE 76 ( ) Shikler Cited by Orlov ( )  
(3) 87 (4) M (5) 3 yrs (6) Scarlet Fever (7)  
Bilateral Bony (8) (9) ? (10) Resection  
of mandible ( ) ? ( ) None (3) Good

CASE 77 ( ) Shreiner Cited by Orlov ( ) 9, 7  
(3) 473 (4) 3 yrs (5) Scarlet Fever (6) Unilateral  
Bony (7) (8) ? (9) Atrophy of jaw ( ) Resection  
of jaw ( ) ? ( ) None (3) Good

CASE 78 ( ) Shreiner Cited by Orlov ( ) 14,  
(3) 90 (4) ? (5) Malaria (6) Bilateral Bony  
(7) ? (8) ? (9) ? Bilateral resection of condyloid  
implanted ankylosis ( ) ? ( ) Shrewy Female (3)  
Cure

CASE 79 ( ) Shreiner Cited by Orlov ( )  
(3) 11 (4) ? (5) ? (6) Congenital (6) Bony (7)  
(8) (9) ? (10) Mass of bone removed ( ) ?  
( ) Fibrosis (3) Fibrous adhesions

CASE 80 ( ) Shreiner Med New 800, 171  
( ) 88, M (3) Apr 800 (4) 4 yrs (5) Acute articular  
rheumatism (6) Bilateral osseous (7) None (8) Opera-  
tion with incision (9) ( ) Vertical incision so  
front of ear Horizontal 1 along lower edge of zygoma  
Portions of neck 3/4 inch thick resected ( ) ( )  
Stiffness overcome by rubber edge (3) f neck open  
2 1/2

CASE 81 ( ) Warner Charleston M J 854, 118  
( ) 7 M (3) Feb 855 (4) 4 yrs (5) Metrical  
pt alaria (6) Right Fibrous (7) Slight lateral Nose  
down (8) (9) ? ( ) Cutting of fibrous bands,  
( ) ( ) None (3) Permanent cure

CASE 82 ( ) Tri al Scim Med Palermo 89  
111 ( ) 0 M (3) Sept 5 800 (4) 3 yrs (5) Malaria  
followed by ulceration (6) Osseous complete to right,  
incomplete on left (7) Shred on left (8) Dislocated  
(9) Chin poorly developed (10) Chained through osseous  
condyle ( ) ? ( ) None (12) Good opening on  
condyle ( ) ? ( ) None (3) ?

CASE 83 ( ) Baurist Bull d Char, Mises, 891  
VIII ( ) 35 F (3) ? (4) From birth (5) Arrest

of develop of mandible (6) Left fibrous (7) Slight  
open N lateral movement (8) ? (9) Slight trophy  
of jaw ( ) Direction of condyle and coronoid process  
on left section of mandible ( ) ( ) None (3)  
Satisfaction

CASE 84 ( ) Leroy Kieferliche m. brech. und. d. d. d.  
Diss Berlin 1883 ( ) 2, F op by Sonnenberg (3)  
June 885 (4) 14 yrs (5) Persistent inflammation  
of right jaw (6) Right (7) Nose (8) ? (9) Re-  
treating chin draws to right (10) Resection of condyloid  
process ( ) ? ( ) None (3) Good 4 cm

CASE 85 ( ) Lando Op by Richs Institut de  
Lasky, Warszawa Thèse de dent. p. 105 ( ) 26  
M (3) Mar 2, 905 (4) 14 yrs (5) Osteomyelitis of  
left jaw (6) Left osseous (7) None on left, 5 mm. on  
right no lateral (8) ? (9) Slight arrest of development  
( ) Bone mass fused No trace of normal parts Piece  
3-4 mm long removed ( ) ( ) Hemorrhage from  
internal maxillary (3) Failure suggests congenital anky-  
losis

CASE 86 ( ) Murphy Setz Clinics, 5 June to 3  
( ) 28 M (3) (4) 4 yrs (5) Abscessed molar tooth  
(6) Right Fibrous (7) None (8) On Thru smooth  
laid (9) ( ) Condyles divided 7 flaps  
retrayed One from roof of mouth and other from hard  
palate ( ) ? ( ) None (3) Permanent result  
not known

CASE 87 ( ) Gaudin Méd de La Suisse Romande,  
902, 1 ( ) 6, 1 (3) Nov 30, 893 (4) yrs  
(5) 1 1/2 on chin (6) Bilateral osseous (7) 3 mm (8)  
(9) Retracting chin, jaw undercloped ( ) Resection  
of bony mass back concealed normal parts ( )  
( ) None (3) Good 1 end of 5 mm Chin had devel-  
oped considerably

CASE 88 ( ) Wernher Zisch f d g. med. 890  
V 44 ( ) 3, M (3) (4) 30 yrs (5) Scarlet  
Fever followed by mercurial poisoning (6) Bilateral os-  
seous (7) None (8) ? (9) Chin undercloped (10)  
Bony condyles connected upper and lower 1/2 beginning  
at front lower teeth Piece of bone removed from each  
of these ( ) ? ( ) None (3) Opening of more  
than 1/4 inch

CASE 89 ( ) Jomero Bull et. t. Soc. d. Char de  
Bucarest V 6 902-3 ( ) 30, F (3) Oct 90 (4)  
Severe ankylosis (5) Osseous Alaria (6) Right osseous  
(7) None (8) ? (9) Retracting chin ( ) Resection  
of ascending ramus ( ) ? ( ) Severe hemorrhage  
(3) Good

CASE 90 ( ) Baross Ein Fall on Kieferliche  
Ungar med Presse 897 ( ) F (3) (4) yrs  
(5) Fracture of jaw (6) Left osseous (7) None (8)  
(9) (10) Resection of parts of bone 5 cm long from  
body of mandible in front of dentin ( ) ( ) None  
(3) chin opening

CASE 91 ( ) Kury Deutsche med. Wochens.  
904 ( ) M (3) 903 (4) ? (5) Osseous chin of  
jaw (6) Right osseous (7) None right, slight left (8)  
Op on 1/2 yrs of age and again at with retraction  
(9) ? ( ) Resection of triangular wedge from process  
( ) ? ( ) None (3) Good after several months

CASE 92 ( ) Kury Rep by Zepher Thib d.  
Paris, 896 (3) 7 F (4) 176 (5) 8 mos (6)  
Location lower jaw (7) Irreducible location both sides  
(8) cm (9) ? (10) Lower jaw thrust forward Mouth  
open and amenable (10) Resection of condyles but not  
resection of bone no muscular action pulled them back to place  
(11) ? ( ) None (3) Excellent

CASE 93 ( ) Van Noord Nederl Tijdschr  
Geneesk 191 271 ( ) 7 mos. M (3) 1970 (4)  
From birth (5) Congenital (6) Bilateral osseous (7)

experience in these cases was a mere coincidence, he daily exposed tumor-bearing mice to temperatures above normal and found not only that their tumors showed degenerative changes, but that the mice lived longer. A spontaneous lymphosarcoma, which developed in a bitch, also diminished rapidly and finally disappeared, when the temperature rose to  $40.8^{\circ}\text{C}$  ( $105.4^{\circ}\text{F}$ ) after the puncture of the zone of Richet. These observations and experiments of Vidal are startling in their significance, and give tremendous point to his statement that all the methods for treating carcinoma which have come out of the experimental laboratory have no beneficial influence whatever unless the reaction which they initiate is accompanied by fever. This is true of all vaccines and toxins, such as the nectin of Bra, Doyen's micrococcus neoformans, the toxins of Coley and the vaccine of Otto Schmidt. The experiments of Bier (6) show that the intravenous injections of foreign defibrinated blood raises the body temperature, and this is true also of the use in the same way of the colloids of gold, silver and copper. The observation of the older physicians, who noted the disappearance of malignant activity following infection by erysipelas, claims our interest in a new way. Pierre Delbet has confirmed the experiments of Vidal on the deleterious action of increased body temperature in cancer.

Reduced to the simplest statement our problem in inoperable cancer has always been twofold: first, to get rid of the gross mass; second, to destroy the progressive metastases. The second point usually loses much of its significance in the overshadowing presence of the primary great mass. If what Vidal and others tell us is true, it is a rational procedure to attack these morbid masses with heat. But a method tending to raise the temperature of the whole body above  $40^{\circ}\text{C}$  ( $104^{\circ}\text{F}$ ) is impracticable because dangerous. In addition it is uncertain, and we cannot regulate it. We are compelled then, to find some method more local in its application which will exert the greatest destructive process on the gross mass of cancer and endanger to a minimum degree the normal connective tissue cells.

The only agents so far found worthy of consideration are hot air, hot water, steam, electrocoagulation, fulguration, and actual canter. Hot water, hot air and steam are shown by Doyen to be of no practical value, because of their slight penetration. Electrocoagulation affects the tissues for a depth of 5 to 8 cm in two minutes. The rapidity of action, the difficulty of control of the electrode,—especially in the cavities—the complicated apparatus necessary together with the refinement of technique and specialized judgment required of the operator make this method impracticable in the treatment of the cavity carcinoma. The de Keating Hart method of fulguration (7)—i.e. the sparking from a high-frequency current of high tension, after the surgical removal of the bulk of the mass especially when superficial—is worthy of notice in this connection. In the hands of the originator by preventing relapses, it has undoubtedly improved the statistics of operative methods in advanced cancer over those where cutting procedures alone have been employed. Durrig and Grau (8) however insist that the only beneficial result from fulguration is due alone to the heat and not to any specific action on the tissue-cells. It is only just to the originator of this method of using high frequency currents to state that he denies that this is the mode of action in his method. He insists that where heat is obtained in this way it is due to the reduction in the length of the spark, replacing the tension by thermic effects, which is a mistaken use of fulguration.

The methods just enumerated in the hands of their originators have added much to our knowledge of cancer therapy. But the apparatus required to carry out the technique is expensive, complicated and expensive. In addition to be effective, it demands not only specialized knowledge, but a refinement of judgment that requires more than the average experience.

In the way of comparison it has been my pleasure to suggest a practical system of applying heat in otherwise inoperable carcinoma of the uterus which has none of the objections that can, with reason, be urged against the method already enumerated (9).

## THE TREATMENT OF INOPERABLE CARCINOMA OF THE UTERUS BY APPLICATION OF HEAT

By J. J. LEECH, M.D., CHICAGO, ILLINOIS

At the present time the treatment of cancer may be easily differentiated into two classes. The first of these is the operable which applies almost wholly to early manifestations of the disease and the second the inoperable which concerns us most at this time.

Inoperable carcinoma may be attacked through attempt to destroy the possible cause by vaccines, toxin serum, etc. or in its attack to change the paladium by which the disease is permitted to progress, such a may be suggested by the theories advanced by Ehrlich under the name of atropesia. In both treatments of the experimental laboratory the above theories and the work based upon them when our recent literature will stimulate our imagination regarding the whole field of cancer research but we cannot apply them now because their value is still undetermined, and the particular paladium of which Ehrlich presumes for growth is not fully understood.

We do know, however, that the cancer cells can be destroyed by the same agents that will destroy the normal cell among these may be mentioned such as heat, actual cauterization and freezing. Our problem is to find in some manner an agent which will affect the physical properties of the growth in such a way as to kill the cancer cell if this cannot be done completely then to retard or inhibit its growth permitting normal cell to retain their growth and function. Certain agents have been found which carcinoma is more vulnerable than are normal cells. One of these is radiactivity in its various forms. Unfortunately the area of application of this agent is limited to such a degree that we are compelled to search for some other element of wider application.

In our study of agent that will inhibit and destroy carcinoma the first that appeals to us is heat. The history of the ancient and

modern use of this method of treating carcinoma is neither unimportant nor insignificant only our manner of using it has been at fault.

In 1905 Paul Ehrlich suggested to M. Hasted (1) the greater susceptibility of certain strains of mixed, inoculable, malignant material to heat. The experimental work, based upon this fundamental intimation of Ehrlich regarding heat has not only been interesting but of great practical value. Hasted showed that carcinoma cells are more vulnerable to heat than are those of sarcoma and die after an exposure of one half hour to 44° C. (113° F.). It has been demonstrated by Clowers (2) that all tumor cell exposed to a temperature of 45° C. (113° F.) in *vitro* die.

Loeb (3) has demonstrated the death of sarcoma cell when exposed to a temperature of 45° C. (113° F.) for thirty minutes, while Clowers (3) and Bielski place it at 44° C. (111° F.) for the same period of time. Jensen (3) places the vulnerability of cancer cell at 47° C. (116° F.) for five minutes.

Lambert (4) has shown a definite relationship of damage between the degree of heat and the time of exposure to both normal and malignant cells. In his experiments have demonstrated that sarcoma cells are destroyed when exposed to a temperature of 42.5° C. (108.5° F.) for from twenty four to forty eight hours, 43° C. (109.4° F.) for six hours, 44° C. (111.2° F.) for fifteen minutes, and 46° C. (114.8° F.) for twenty minutes while the normal connective tissue cells survive these exposures. M. E. Jensen has shown that the death point of carcinoma cell is 55 to 56° C. (132° F.). An identical degree of heat is necessary to destroy the mucinococcus non-formans which he believes is the etiological factor in cancer.

Valhi (5) in a most interesting observation noted the arrested development of tumors in four patients with a temperature above 40° C. (104° F.). Fearing that his

heat in these cases is decided upon, I would strongly advise against the use of the curette or other operative measures, for the reason that the heat is distributed through the medium of the pathological overgrowth which we wish to destroy. Heat does not encourage the extension of metastases, while the curette and knife do. Again scar tissue is not formed after the use of the curette but it is the usual sequel after the application of the heat and I have yet to observe the redevelopment of cancer in cicatricial tissue. Where the surgeon believes that a modern total hysterectomy should be the operation of choice in the less extensive forms of uterine carcinoma I know of no more rational procedure than the methods here outlined, which should precede the final operation at least by three or four weeks. In a personal case where the treatment was applied to an active sinking feeding vegetative like mass springing from the external edges of a practically destroyed cervix uteri no evidence of carcinoma was found on serial section eight months afterwards, when the uterus and cervix were removed through the abdomen.

I shall leave the statistics of my results in the treatment of inoperable carcinoma to a future paper. All that may be said at the present time is that I believe that a large number of cases hitherto practically hopeless when not presenting themselves for treatment will give approximately fifty per cent remaining free from recurrence over five years. I will turn, my work along this line, to cases in which the limit of benefit to be obtained by the application of heat in inoperable carcinoma has not yet been reached.

I am working out a method of determining the amount of heat entering the pathological and normal tissues and the distribution of heat in the various degrees of heat in the tissue at various distances from the heating point. It will be determined. This will make it more definitely and accurately certain that the required temperature known to destroy cancer is being the part in heat.

The management of implants in the

most serious of which is the prevention of rather late hemorrhages is a matter of importance. In fifty cases this sequel has followed in two private and in two clinic cases. Only one of these a private case, died from the hemorrhage. It will probably prove to be true that the uterine arteries, or possibly even the internal iliacs, should be tied in every case immediately preceding the treatment by heat.

In mentioning these important problems growing out of the practical application of my method I do not wish to be understood as minimizing the great benefit which this technique has already given to a rather large number of otherwise hopeless cases of inoperable cancer of the cervix and body of the uterus but rather to express the hope that with the improvement which can undoubtedly be made in the use of heat in cancer a wider application of this extremely valuable method may be found.

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The penetration of heat by this method can be definitely although perhaps crudely determined and regulated. When the malignant process is at all accessible the method has almost no limitation. The required apparatus is not only easily portable but also inexpensive. I refer to the levelling chest through a most efficient electric heating iron which can be perfectly regulated by means of a rheostat when applied to the involved tissue. With this electric heating iron and my water cooled speculum and the vaginal dilator a maximum penetration and dissemination of heat is obtained in the involved structures. More than the low degree of heat which my experiment shows to be more effective than the intense heat already mentioned can be maintained accurately. The low degree of heat does not burn up the cancerous material metal makes it so hot that the hand of the surgeon encased in a medium weight rubber glove cannot hold it. When this degree of heat is reached and maintained for from ten to twenty minutes the cancer cells are absolutely killed while the normal tissue cells are not injured. The important thing is not to convert the pathological into charcoal. The charcoal or carbon thus formed inhibits the further dissemination of heat not only through the cancer mass but beyond. More than this when the pathology is converted into charcoal drainage is prevented for a number of days. The permit of the absorption of a large quantity of broken down cancer. If then the average of these patients can tolerate and many of them die as a result of this mistaken method of applying heat. Carbonization is produced in a few minutes by a cautery heated to a bright cherry red color. Carbon inhibits the dissemination of heat. To overcome this still greater degrees of heat are required which are extremely difficult to control endangering the rectum, the bladder and the ureters. In another publication (10) I have given the detail of some experimental work which will illustrate the practical application of this very important factor. The heating iron when used through the water cooled speculum, should not be hot enough to scorch a pledget of white cotton if laid on the heating iron

even for half an hour. A smoke or smell of burning tissues should not sue from the speculum as would occur if they were being carbonized. The car placed next the speculum should hear only a gentle inner sizzling while the attending heat in the diseased mass.

My experimental work and the operation itself demonstrate that when the carbon is applied to the affected tissues not only is there much less destruction of normal cells, but a far greater penetration of heat occurs than all calorimeters. Cancer is destroyed when the temperature in the mass is raised to  $C = 66.5$  ( $C = 151.7$  to  $159.9$  F) while the stability of normal tissues is not changed until the temperature exceeds  $55$  C. to  $60$  C. ( $131$  F to  $142$  F). The basic idea then of this treatment — and this can not be too often emphasized — is not cauterization but the penetration and dissemination of heat in the *primary mass of cancer*. There is no other method or technique of similar merit that will influence in a destructive way a great area of malignant tissue with a minimum amount of harm to the uninvolved structures. This technique in a tremendously effective way destroys the primary malignant focus. With this accomplished the newer methods, especially the X-ray that have been shown to be of upmost value in the destruction of the metastasized foci in or just outside of the pelvis make a combination of merit in the management of these otherwise hopeless cases, most promising in its possibilities. From my experience I am convinced that it is not always best to attempt to destroy at one sitting a large mass of carcinoma. These patients are rarely in the condition which invites long anthesis. The application of the heat to a degree which does not destroy the major part of the exuberant overgrowth and aids the patient of her local focus of mixed infection produces within two weeks a surprisingly beneficial result. This is especially noticeable if cachexia has at all been a marked symptom. A second or even third application of heat is not only safer unless the involved structures are small, but it gives the operator a much better opportunity to reach, finally the outermost confines of the disease.

When my technique in the application of

the last three years had been reduced to 3.7 per cent.

In this country the chief exponent of this operation was Sinclair of Manchester and since his death the method appears to have fallen almost entirely into disuse. Among my own early operations I made use of the vaginoperineal incision in a few instances, but in the second case one of cancer of the body an implantation metastasis arose in the vaginoperineal scar within a few months after that I ceased almost entirely to employ this incision in operating for uterine cancer.

At about the same time as the extended vaginal operation was being worked out the example set in the surgery of mammary cancer stimulated operators to endeavor to find a method of removing the uterus together with its neighboring connective tissue and lymphatics. Hysterectomy by the abdominal route was, therefore, once more attempted and in 1895 Clark and Rumpf first dissected the ureters in order to remove as much of the parametrium as possible and Rut proposed the removal of the pelvic lymphatic glands. In 1898 Wertheim in Vienna began the remarkable series of operations which has served to establish the operation and make it known by his name in all parts of the civilized world. For the last ten years this operation has been gradually displacing the extended vaginal hysterectomy which is now regarded as its only possible rival. The immediate result is steadily improving and many of the dangers and disadvantages of the operation have been overcome thus suppuration and sloughing of the abdominal incision with consequent hernia are now prevented by carefully guarding the incision during the operation septic peritonitis is prevented by suitable vaginal antiseptics and shock and exhaustion become less common with increasing experience.

Surgeons attach great importance to the use of the actual or galvanic cautery in operations for uterine cancer in this country. Herbert Spencer is the chief advocate of this method. In America Byrne achieved remarkable success by its use and N. O. W. Rider has recently very strongly recommended combined vagino-abdominal hysterectomy by

the cautery method. In his hands the method has given an absolute five-year curability of 16.5 per cent in 39 cases.

In this country the abdominal operation is becoming the routine method because in the first place it affords better oversight of the field of operation than the vaginal method in the second place because operations by the vaginal route have never been extensively practiced here, and thus skill is easier of attainment in a new operation if it is performed by the abdominal method and thirdly because by the abdominal route alone it is possible to remove the affected glands. This last advantage is likely to prove of increasing value in the future. Many operators in their haste have concluded that it is useless to remove the glands and have stated that when they are invaded the disease always recurs after operation. Wertheim has however published 14 cases in which carcinomatous glands were found, and which nevertheless remained free from recurrence for upwards of five years. For the reasons stated the abdominal operation is likely to become more and more generally adopted. It cannot, however, be applied in all cases. The prolonged Trendelenburg posture is dangerous for old patients for those who are very fat and for certain women with visceral complications. In such cases the vaginal operation affords a better immediate outlook and in the old patients especially is often followed by a long freedom from recurrence.

#### DIFFICULTIES OF ESTIMATING RESULTS OF OPERATIONS FOR CANCER

The difficulties of estimating justly the results of any curative method of treatment of cancer are very great by reason of the uncertain course and duration of the disease. Cancer does not grow with equal steps, but now halts, again recedes and anon makes rapid and tumultuous progress. In different patients the earliest symptoms make their appearance at various stages of the disease. When cancer begins in the uterus one patient has recognizable symptoms at the very beginning while another is conscious of nothing unusual until the disease is already very far advanced. The duration of the disease is in

## THE RESULTS OF RADICAL OPERATIVE TREATMENT OF CANCER OF THE UTERUS

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## HISTORY

THE operative treatment of uterine cancer has made slow but on the whole continuous progress since surgery was made safe by the work of Lister and Pasteur. Until thirty years ago surgical intervention was practically limited to cancers of the vaginal cervix, and the operation was done with the actual or galvane cautery. In 1882 Pawlik reported 136 intravaginal amputations of the cervix performed by C. Braun with the galvane *écraseur*; ten patients died, and of the survivors at least twelve remained free from recurrence for five years and upwards. Byrce in 1889 had done 81 cases by the galvane cautery, and in 38 there had been no return of the growth for periods varying from 3 to 17 years. The operation was limited in its scope and was soon superseded by Schuchard's supravaginal amputation of the cervix, which was applicable to a larger proportion of cases, had a mortality arising at first from 8 to 12 per cent and was followed by freedom from recurrence for two and three years in about 40 per cent of those reported. In this country Lewers did 33 of these operations, in six of which the patients remained well for more than five years; the operative ratio not given, but was probably much less than 20 per cent; the five years absolute curability would thus not exceed two per cent.

Vaginal hysterectomy was first performed on regular anatomical lines by Caerny and in the later eighties began to displace the supravaginal amputation in England. The first important discussion on the subject took place at the Obstetrical Society in 1885 when W. Duncan introduced two tables of collected cases, one showing 137 cases of abdominal extirpation of cancerous uterus with 99 deaths, an immediate mortality of 72 per cent and the second table embracing 276 cases of vaginal hysterectomy with 79 deaths, or 28.6 per cent mortality. The

general conclusion arrived at in the paper and subsequent discussion was that the risks practically condemned vaginal hysterectomy as an operation for cancer. Seven years later in a review of the subject in the *Journal of Obstetrics and Gynaecology of the British Empire* I examined the literature of the subject and showed that in competent hands the operation was applicable on an average in from 23 to 33 per cent of the cases which applied for treatment; the immediate mortality was 5 per cent or less; 25 to 33 per cent of the cases that survived the operation remained well and free from recurrence for five years and upwards; and the absolute curability of uterine cancer by this operation varied between about 4 per cent (Schauta and Waldstein) and 9.2 or 10 per cent (Winter and Hattenbach).

In the same review reference was made to the extended operation performed with the help of a vaginopelvic incision, by means of which the parametrium could be widely removed. In 1901 Schuchardt had reported on 60 such cases and claimed an absolute curability of 24 per cent of the number of cases presenting themselves for treatment. Since then the operation has been largely practiced by certain operators, and its advocates claim that access to the seat of operation is as good, that the danger of injuring neighboring structures is less, and that as wide a removal of the parametrium can be made by this route as by the abdominal. The dangers of bleeding and sepsis seem to be little inferior to those of the abdominal operation and the risk of implantation of cancer cells would appear to be equally great.

By the extended vaginal operation Schauta, until 1911 obtained a five years absolute curability of 16.6 per cent on 211 operations for cervical cancer performed in a series of 447 cases applying for treatment. The primary mortality was 8.0 per cent, but in

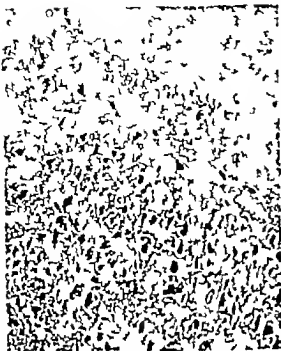


Fig. 11. Case No. 7. Photomicrograph of section from tumor mass showing numerous multinucleated giant cells embedded in cellular granulation tissue. Area of necrosis at one end with leucocyte infiltration along boundary zone. X 80.



Fig. 13. Case No. 7. High power photomicrograph of section from tumor mass showing the large giant cells with accumulated and reticulated cytoplasm. A few smaller multinucleated cells are seen. Note polymorphous character of cells in stroma.

autonomous growth but is in reality a low grade inflammatory process localized and due probably to trauma.

Those opposed to the view that the lesion is inflammatory assert the following points:

1. There is tumor formation.
2. There is steady increase in size of the lesion.
3. The microscopic picture of giant-cell riot and invasion is conclusive.

It is the dissection of such a picture that furnishes another reason for this paper.

1. *Regarding tumor formation.* Primitive granulation tissue will form tumor like masses in any part of the body in which it is permitted to proliferate as such.

2. *Regarding steady increase in size.* According to Adams, the striking feature of an inflammation caused by a gentle irritant is proliferation. Going hand in hand with destruction of the trabeculae from disturbance of nutrition and pressure necrosis due to effusion and dilated and varicose blood vessels

are seen constant efforts at repair by replacement granulation tissue.

3. *Regarding giant-cell invasion.* This has heretofore been the sheet anchor upon which the diagnosis of giant cell sarcoma has been based, the histologic picture showing a field of giant-cell riot without architectural uniformity or arrangement.

It should be borne in mind that these cells are neither tissue builder nor tumor forming cells. Their function is that of scavenger. Their presence is an evidence of and is due to a low grade inflammatory non-suppurative process. They are rarely seen in acute inflammation, but are frequently observed in numerous mild chronic inflammatory conditions. These giant-cells are apparently formed by the fusion of many phagocytic endothelial cells brought together as a result of the stimulus offered by disintegrating bone structure.

the highest degree uncertain of two women with the affection apparently at the same stage one may die in a few weeks and the other live for several years. In the practice of the operating surgeon groups of cases successful as regards ultimate cure alternate with other groups apparently similar but all ending in rapid recurrence. All these things tend to show that the actual living virus of cancer when at length it is discovered, will be found to pass through varying phases of growth and activity now active and virulent now stationary or sluggish.

These uncertainties in the course of the disease have been illustrated and to some extent explained by the experiments on mouse cancer. Here also marked variations are observed in the rate of proliferation of the cancer-cell. Some tumors on inoculation grow rapidly certainly and progressively others increase slowly till other tend to regress and disappear and all degrees of virulence are found between these extremes. The tumor cells exhibit what may for convenience be called positive and negative phases of proliferation.

On the other side marked differences exist in individual host as well as in the various organs and tissues of the body. In some organs and persons cancer appears to take root easily it grows rapidly and soon becomes generalized. In some very early cases of uterine cancer the regional glands are already invaded while in patients dead of the disease the glands are reported to be free in as many as 54 per cent. The same uncertainty is illustrated in the varying fate which befalls tumor emboli in the lungs of patients with malignant chorio-epithelioma. Relative immunity arising in degree renders in some organs and tissues and in certain individuals. Not every person exposed to the causes of cancer whatever these may be develops the disease. Many are called but few are chosen.

Here then are two factors which go far to explain the impossibility of forming an opinion as to the course of the disease and as to the probable result of operation in any individual case. Little that is definite is known of either of these factors and we can only hope that patience and perseverance will

eventually lead to their elucidation. In the meantime the uncertainty and variability of the disease render it imperative that, in forming an opinion as to the results of any method of treatment observations shall be made on a large number of cases, and shall extend over a very considerable time. Averages are of use in comparing results in the mass, though they are of none in individual prognosis.

#### STANDARD FOR COMPARISON

In estimating the risk of any new operation it has always to be borne in mind that while there are dangers inherent in the operation there are also dangers that appertain to the operator. The first ten or twelve operations carried out by an individual surgeon usually teach him most of the difficulties and dangers that are encountered, and with increasing experience the mortality due to the personal factor rapidly diminishes. The bearing of this remark lies in the application thereof. I think it would be just to exclude from the general consideration of the subject the first ten or twelve cases of Wertheim's operation done by each individual operator. In this way a true idea of the danger due to and inseparable from the operation itself might more easily be formed.

In proportion as the operation for uterine cancer has become more extensive the demand a regards ultimate cure has become more exacting. At first since the average duration of the disease from the onset of symptoms to the death of the patient was understood to be one and one-half years, freedom from recurrence for two years after operation was a surgical triumph then a term of three and later of five years freedom was demanded. Lately it has been suggested by Wesel among others, that the term should be extended to seven or more years, inasmuch as a certain number of patients show late recurrence. That this undoubtedly happens was shown in three of my patients in whom the disease returned after six, six and one-third, and nine and one-half years, respectively. But art is long and time is fleeting, and the necessity is urgent of a consistent and sufficient standard to

enable us to estimate and compare results. For this purpose five years would seem to answer all legitimate requirements, and it is to be desired that published results should conform to this standard.

Only those who have examined published writings with a view to find out what the operations for uterine cancer can fulfill can appreciate the chaos and confusion that have arisen from every writer setting up his own standard. The literature of the subject is largely made up of attempts to estimate the value of the different operations by arithmetical methods which bristle with fallacies of every conceivable kind. The higher mathematics has been called upon to assist for instance in the formulae of Winter and Waldstein. To the making of statistics there is no end, and many figures are a weariness of the flesh. All complicated formulae are superfluous, and it appears to me the only fairly reliable estimate of results can be made by comparing the total number of cases of cancer that apply for treatment with the number known to be free from recurrence five years later. And even here there are many opportunities for error.

Another important observation, that should be but is not superfluous, must be made that under no circumstances is it any longer justifiable to publish the mixed results of treatment of cancer of the body and cervix. The two varieties should be kept entirely distinct and should be separately discussed.

In the large German clinics we find that cancer of the uterine cervix affords a ratio of operability of 45 to 60 and even higher and an absolute curability of 20 per cent. Wertheim's five-year completed statistics of 450 cases show an operable ratio of 46 per cent with a primary mortality of 19.5 per cent and an absolute curability of 9 per cent, 186 of 979 patients being known to be alive and free from recurrence at the end of five years.

In this country, with rare exceptions, the operability is not greater than from 30 to 40 and the total curability than 10 per cent. The low operable ratio is not due to any difference in the disease, but rather to the fact that the general public and the main body

of the medical profession have not yet grasped the truth that uterine cancer is curable in a large proportion of those cases that apply early for treatment. The consequence of this ignorance is that women do not seek medical aid promptly and that when they do the necessary investigation is only too often delayed.

#### THE SURGERY OF UTERINE CANCER IN GREAT BRITAIN

In Great Britain as generally speaking in America, gynecological work is spread over a large number of clinics of small or moderate size, and the opportunities afforded to the individual operator are comparatively limited. In testing and establishing a new operation such as the extended abdominal hysterectomy for uterine cancer this arrangement has many disadvantages when compared with the large clinics and extensive opportunities that are found on the European continent. To this more than to any other cause is probably due the fact that these operations have been practiced extensively and successfully in Vienna and Germany far in advance of the work that has been done here.

Published papers in the British journals on the extended operation for uterine cancer have been comparatively few and to a large extent, made up of descriptions of technique with occasional suggestions for its improvement. Hastings Tweedy in 1911 published notes of 48 cases of uterine cancer operated on by the abdominal method. Among these were included 33 operations for cervical cancer with an immediate mortality of 8 or 24 per cent. Comyns Berkeley has described the results obtained by him and Bonney in the three years ending June 1910. Among 112 cases of cervical cancer 71 were operated upon, an operable ratio of 63, the immediate mortality was 22.5 per cent, and the patients remaining free at the end of three years amounted to 40.5 per cent of those operated upon, or 54.9 per cent of those recovering from the operation. McCann, to June 1912 had done 53 Wertheim operations for cancer of the cervix, with three deaths, and in the five years ending June

1911 had seen only five inoperable cases. Cuthbert Lockyer and Child have also discussed the operation. There are no British five-year statistics.

I propose now briefly to examine my own work on uterine cancer which has been done in the gynecological department of the Birmingham General Hospital. This department has 14 beds and is a fairly typical one in the country. In the last ten years most of the out-patients have been seen by the assistants in this department Messrs. Hewitson and Beckwith Whitehouse, who have also performed some of the operations, and have assisted in most of mine. I have taken all the cases applying for treatment in the out-patient department and all those admitted to the wards, and have added all my own private cases. My thanks are due to Miss M. B. Webb M.D. whose very efficient and enthusiastic help in following up my result I here gratefully acknowledge.

From the year 1896 until December 31, 1913 there have been 596 cases of uterine cancer. Of these in 67 the disease affected the uterine body and in order to clear the ground I deal with these first. Among the 67, 15 vaginal hysterectomies with no mortality and 29 abdominal hysterectomies with 3 deaths were performed.

The five-year results are given in the accompanying table.

#### CASES OF CANCER OF THE UTERINE BODY SEEN UNTIL JUNE 30, 1909

Total seen 596  
Radical operations 15 = 6 per cent  
Deaths following operation = 6.4 per cent  
Cases free from recurrence for 5 years and up wards  
Absolute curability = 4 per cent

The absolute curability of cancer of the body of the uterus here shown appears small when compared with the rate of 50 to 75 per cent usually claimed, but I believe the latter rate is based largely on fallacies and small numbers, and will prove to be exaggerated.

#### CLINICAL CANCER

Until the end of 1913 there were 529 cases of cancer of the cervix uteri. These can be

conveniently divided into two groups according as operation by the vaginal or the abdominal route was the method of choice. In the first period, lasting until the end of 1905 there were 246 cases of which 37 were operated upon by the vaginal method with one death and 7 by the abdominal route with 6 deaths. In the second period from January 1, 1906 to December 31, 1913, 283 cases were seen, among whom 20 were operated upon by the vaginal route with no deaths and 72 by the abdominal with 8 deaths. The total immediate mortality of the vaginal method has been 57 cases with one death or less than 2 per cent and of the abdominal 79 operations with 14 deaths, or 17.7 per cent. The great majority of the abdominal hysterectomies were performed by Wertheim's method.

The ratio of operability has steadily increased. In the years 1896 to 1899 it was 14 per cent; in the last four years it has been more than 36 per cent.

#### OPERABLE RATIO

1896-1905 inclusive	14 per cent of 246 cases
1906-1909 inclusive	20 per cent of 54 cases
1910-1913 inclusive	36.4 per cent of 20 cases

My total five-year result up to June 30, 1909 has been investigated, and shows that with an increased operable ratio and the adoption of the abdominal method of operation, the absolute curability of my cases has risen from 5.5 per cent to 10.2 per cent.

#### RESULTS OF VAGINAL HYSTERECTOMY FOR CANCER OF THE CERVIX TO JUNE 30, 1909

5 operations in 285 patients  
Average operability about 9 per cent  
Deaths following operation 0  
Patients survived 5 years and upwards 6  
Absolute curability 5.5 per cent

#### ABDOMINAL HYSTERECTOMY FOR CANCER OF THE CERVIX TO JUNE 30, 1909

8 cases in 94 patients  
Operable ratio 2.3 per cent  
Deaths following operation 0  
Free for 5 years and upwards 0  
Absolute curability 0 per cent

Of the patients surviving operation 16 of 51 or 31 per cent of the vaginal, and 10 of 23 or 43 per cent of the abdominal remained well.

and free from recurrence for five years and upwards

It follows from my experience that although the final results hitherto obtained in this country are inferior to those of the best Continental clinics, they are steadily improving, and may be confidently expected still further so to do. The immediate mortality of the extended abdominal hysterectomy for cervical cancer has fallen thus in my own work, in the six years ending December 31 1913 there were six deaths in 62 operations, a rate of about 10 per cent. The operable ratio has doubled in the last ten years and may be expected to rise considerably further when the possibilities of the operation are grasped by the profession at large and by the public. The total number of patients remaining free from recurrence for five years and upwards has also increased nearly twofold in the last decade and we may hope before long with the surgical methods now at our disposal to achieve an absolute curability of 25 per

cent of all cases of cancer of the uterine cervix

Hardly a year passes free from the joyous announcement of new and certain cures for cancer. Every new treatment is hailed with acclamation tried with enthusiasm claimed to be almost consciously selective in its action on the cancer-cells and then dropped quietly into the oblivion of disappointing and forgotten things. Hitherto surgical methods alone have stood the test of time and have justified their use, not only by progressively improving results but also by affording opportunities for increasing our knowledge of the pathology of the fell disease in the human race. The exact nature and the mode of origin of cancer are still veiled from our view and the seer who shall expound these is eagerly awaited. In the meantime it behooves us to continue to give to our patients the benefit of those methods which gave the greatest promise being neither unduly lifted up by success nor cast down by our many and grievous disappointments.

## ULCER OF THE STOMACH IN CHILDREN BEFORE PUBERTY

D. CHARLES D. LOCKWOOD, M. D., F. A. C. S., CHICAGO

**R**OUND ulcer of the stomach and duodenum in children before puberty is relatively rare, although I am convinced from recent experience and from a review of the literature of the subject that it is a much more common lesion than most surgeons realize. I believe that many obscure abdominal symptoms in children heretofore ascribed to appendicitis, gastroenteritis, ptomaine poisoning and the like are due to ulcers.

All authors whom I have consulted say Jacobi declares that true peptic or round ulcer of the stomach and duodenum is rare in children. The following statistics indicate the rarity of ulcers in children. Welch (1) found one case in a child under ten in a series of 607 cases of gastric ulcer. Dwyer (2) in a series of autopsies at a children's hospital found nine cases of gastric ulcer and four of duodenal. Wallensten, quoted by Osler, found six cases of gastric ulcer in 100 autopsies at the Baby Hospital, New York City. Koplik reported only one case of gastric ulcer in his experience among 100,000 cases of diseases in children.

After recognizing its rarity, we must realize that ulcer is full of interesting material for the surgeon. It is the subject from the surgical point of view. The proper basis of judgment is gained from all medical literature, which has been upon personal experience with one hundred and fifty members of the association and all children's hospital in this country and Canada supplemented by a thorough review of American and foreign medical literature and, for me, by the Nelson Rose Collection.

Before reporting my own case and others collected by me, I will briefly discuss the etiology, pathology and diagnosis.

**Etiology.** Reisch (Grague) ascribes the rarity of ulcer in children to the small amount of acid in the gastric contents of children, and to the motility and rapid emptying of the stomach. Among predisposing factors may

be mentioned the following: burns, especially in young children; wasting diseases, especially tuberculous; local injuries, e. g., purpura, hemorrhages, leukemias, septicemia, scurvy, anemia and chlorosis in young girls; follicular gastritis (three cases reported by Holt).

**Pathology.** The pathology of peptic ulcer in children does not differ markedly from that in adult. The ulcer may be simple or multiple. In very young children they are more often superficial erosion and the deep funnel shaped ulcer so characteristic in adults is rare. In older children more typical ulcers are found and perforation is common. Ulcers in children are relatively less frequent in the pyloric region. They are found most often on the posterior wall, near the cardia and along the greater curvature. Perforation in the majority of reported cases confirmed by autopsy or operation occurs through the posterior wall into the bursa omentalis or through the lesser curvature into the pancreas. Many of the reported cases have been associated with tuberculous and it is often difficult to distinguish simple ulcer from tubercular erosion.

**Diagnosis.** The possibility of gastric ulcer should be kept in mind in the examination of every child presenting abdominal symptoms. Appendicitis is the condition most often confused with gastric ulcer. Ulcer has been overlooked at operation and discovered at a autopsy. Pain in the epigastrium, hematemesis, and bloody stool are conclusive signs. The two latter are usually absent and pain is often indeterminate and not well localized. Pain, worse at night, loss of weight and chronic indigestion are usually present. These symptoms should suggest ulcer and physical examination, aided by microscopic examination of the stomach contents and tests for concealed blood will render the diagnosis conclusive. In my case the diagnosis was made through palpation of the pyloric region of the stomach. During a peristaltic pain the gas could be felt to

gurgled through the pyloric opening and was followed by immediate relief of pain. At varying intervals the child would cry out with pain, relaxation and complete relief would follow the escape of gas through the pyloric opening. I made the discovery in a purely accidental way but I believe it is a most valuable diagnostic sign.

Gastric ulcer must be differentiated from pleurisy, empyema, acute gastro-enteritis and appendicitis. Routine examination of the chest in suspected abdominal lesions will eliminate chest conditions simulating ulcer. Acute gastro-enteritis can be excluded by microscopic examination of the stools for concealed blood. Appendicitis, which has been often confused with ulcer, can be excluded by a differential blood-count and examination of the stools. The pain of appendicitis is often in the epigastric region and is rarely so well localized as in adults.

*Report of case.* Lillian B. age 3; had never been robust and had never menstruated but prior to January 9 was in normal health and engaged in all of the usual activities of children. At this time she was suddenly seized with pain in her left side. Pain was so severe that she cried out. A diagnosis of pleurisy was made at this time. She soon complained of pain in the abdomen which she localized 4 times in the epigastrium and 10 times in the lower abdomen. Appetite was good and food did not seem to distress her. She vomited but once and there was no macroscopic blood. Chief complaint was pain, worse at night and paroxysmal in character. During paroxysms she would cry out and place her hand over the abdomen. Child was hungry and constipated.

*Physical examination.* Anemic, emaciated girl of normal intelligence. Heart and lungs negative. Scaphoid abdomen. Slight tenderness in epigastrium. Appendix palpable but slightly tender. No abdominal rigidity. Kidneys palpable but not tender. Black tarry stools. Two blood counts on successive days showed 9000 to 8000 leucocytes. Stomach analysis free hydrochloric acid slightly in excess. Blood present. Microscopic examination of stools showed blood.

*Surgical treatment.* April 8th abdomen opened by right rectus incision. Stomach found adherent for its entire length. Adhesions were especially dense at the pylorus and cardia. They were cartilaginous hardness to the pylorus and it was impossible to draw the stomach outside of the abdominal cavity. Posterior gastro-enterostomy was impossible and an anterior operation was done with a long loop of jejunum. Even this was difficult on account of immobility of the stomach. An adherent retro-

caecal appendix covered by a veil of adhesions was removed.

*Post-operative results.* All pain ceased after twenty-four hours. Food did not distress, digestion good. Patient very hungry. Bowels moved daily after third day without cathartics. For two months patient remained well and gained fourteen pounds in weight. She then began to fail. There was little pain, but all food was vomited and there was rapid emaciation. Her condition grew steadily worse till July 9, 1913 when I reopened the abdomen hoping to reestablish drainage which roentgenograms showed faulty. At second operation, stomach, mesentery, and transverse colon were so densely adherent to the abdominal wall that it was impossible to expose the stomach wall. Retroperitoneal glands were enlarged and all tissues involved were of cartilaginous hardness. I concluded the condition was malignant and inoperable. There was slight improvement after operation, and then there was steady decline until 14 weeks after operation, when she died of starvation.

*Post mortem.* Deep ulceration on greater curvature where transverse colon omentum and jejunum were densely adherent. Infiltration of new growth around healed ulcer resembled cartilage. Pylorus was surrounded by this same dense tissue. Liver studded with metastatic growths. There was also a general metastasis, involving peritoneum, small intestine, caecum at site of removed appendix, kidneys, retroperitoneal glands, etc. Dr. Stanley P. Black made diagnosis of primary sarcoma of stomach from gross specimen, but on microscopic examination tumor proved to be carcinoma, secondary probably to round ulcer of the stomach.

#### CASES REPORTED IN LITERATURE AND ADDITIONAL CASES COLLECTED BY THE AUTHOR

There have been gathered from the literature about 60 cases of gastric ulcer in children. These are reviewed by Stowell (3) by Cutler (4) and by Jacobi (5). I have collected, in addition to these, about 50 cases from the literature and 15 cases not previously reported through correspondence, making about 125 cases in all. I shall report only those cases treated surgically at this time and leave the remaining cases to be reported in the Transactions. Dr. F. B. Lund (6) reported a case operated upon by him, and was able at that time to find only two other cases treated surgically. I am able

to report the following cases subjected to surgical treatment

#### OPERATED CASE

Author Case

C. H. H. (2) report on case 6. A 6-year-old girl 1 month before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

J. W. (3) report on case 7. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

J. W. (4) report on case 8. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

J. W. (5) report on case 9. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

J. W. (6) report on case 10. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

J. W. (7) report on case 11. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

9. Van Herten (1) report on case 12. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

10. Van Herten (2) report on case 13. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

11. Van Herten (3) report on case 14. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

I have collected the following cases from the medical literature of all countries through the aid of the Nelson Research Bureau

12. Van Herten (4) report on case 15. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

13. Van Herten (5) report on case 16. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

14. Van Herten (6) report on case 17. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

15. Van Herten (7) report on case 18. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

16. Van Herten (8) report on case 19. A 6-year-old girl 13 months before attack had been lost of spirit, general malnutrition and pale. The night before the attack while playing he was seized with pain in the abdomen symptoms of peritonitis with peritonitis. Operation made 1/2 inch above the umbilicus. Recovery in 10 days.

ulcers, one at the cardia, the other at the pylorus. Pylorus narrow and musculature hypertrophied.

4. Eross' (16) case. A twelve year old girl, dying of cute miliary tuberculosis frequent gastric pain complained of Appetit small. Section showed round ulcers the stomach. One perforation into the bursa omentalis, which Eross considered to be non tuberculous.

5. Wertheim's (7) case. A ten-year old girl showed symptoms of gastric ulcer of the stomach (loss of appetite, pain and bloody vomit and stools). Recovery in five weeks with careful dietetic treatment.

6. Malinowsky's (18) case. An eight year old girl died, symptoms of gastric ulcer especially vomiting of large quantity of blood. No autopsy reported.

7. Cade (9) reports a autopsy of a 10 and one half months old boy who had suffered from yellowish diarrhoea and vomiting also had a round ulcer on the posterior wall of the stomach that had perforated into the bursa omentalis. Its anterior portion adherent to the liver.

8. G. Busset (20) reports one case. Boy forty five hours old. Six hours before death began to bleed from bowels, rapidly collapsed, and died. Autopsy showed typical gastric ulcer of cut form, with clean cut margins, on posterior wall of the stomach, near lesser curvature. About one half inch from the cardiac opening. Perforated.

9. M. Bowers (21) reports one case girl, age eight. Illness commenced by nausea and vomiting and occasional pain. Acute attack thereafter pain in the epigastric region and vomiting. Vomitus acid and contained blood. Also blood in the stools during the attack. Pain controlled by morphine alkalies given to neutralize acid. No recurrence in four months.

10. E. Cantley ( ) reports one case girl five years and four months. Sometimes pain in the abdomen. Attack began with vomiting blood, stools constipated black. Anæmia, enlargement of spleen. Improvement and cure under treatment. No return of symptoms. Diagnosis not certain but author believes it to be a case of simple gastric ulcer.

11. Mack (3) examined 7 cases operated on for gastric ulcer in regard to the first appearance of symptoms. He found that symptoms of ulcer appeared four cases before the age of ten in nine cases between the ages of ten and fourteen. In 3 cases (75 per cent) in all during childhood. In reports but no case before puberty as follows.

Female thirteen years old pain began at age of seven, omitted at the age of twelve.

Cutler (4) reports three cases from the Massachusetts General Hospital and addition fifteen others not included in my report but reference to original paper is given below.

Roth (4) reports the case of girl thirteen years old. Symptoms of dyspepsia death sudden from peritonitis. Perforation of stomach in smaller curvature follows gastric ulcer almost inches broad.

Leith reports the case of a girl age ten. A month after recovery from croupous pneumonia began to cough, left-sided empyema developed causing death. Autopsy showed empyema cavity on the left side with perforation of the diaphragm also blood in the intestines and an ordinary perforating ulcer nearly circular in the stomach, just in front of the greater curvature, four and one half inches from the cardia end. Ulcer adherent by its floor to the spleen, and a supporting track passed upward and inward between the adherent spleen and stomach directly to the perforation in the diaphragm.

Donné (16) reports the case of a girl three years old. A topsy showed in the midst of a punctated redness within the upper half of the small curvature a little but depressed beneath the surface of the mucous membrane the size of a ten cent piece. Diagonal rays seemed to run out from its center in every direction. The depressed spot was also in folds and the fibrous tissue was thickened showing cure from a simple lesion.

Goodhart (27) reports case in new born infant sex not stated. Vomited blood and died a thirty hours. Autopsy showed stomach distended by blood clot, with small oval ulcer about one eighth inch long at the cardiac end close to the greater curvature. Edge of ulcer very sharp, the bottom an open artery. Cutler says he includes this case among the chronic ulcers from the description of the ulcer. Perhaps it should be classed among the acute cases.

Lebert (28) giving statistics for Breslau, includes one case. His table of chronic simple gastric ulcer between the ages of five and ten years, but no detailed statement of the case.

Deloro (29) describes a post mortem specimen of case reported in 1866 to the Académie de Médecine de Lyon. Infants, few days old died of intestinal hæmorrhage. Autopsy showed several ulcers of the stomach, in addition only the mæcum.

Faulhaber (30) reports all thirty-two cases of ulcer of the pylorus two of these in children as follows.

Case. Female four years old. Periodical pain and digestive disturbances since birth. Diagnosis by roentgen ray. Medical treatment without cure.

Case. Male five years old. Pain and digestive disturbances for years. Diagnosis by roentgen ray. Medical treatment.

L. Fischer (1) reports two cases.

Case. Girl, nine years old. Generally backward development. For some time bloody omits gummy stools, stomach distended and tender. Prolonged medicinal and dietetic treatment for ulcer cure.

Case. Girl, fourteen years old. Long ill health. For three years omitted blood times with frequent attacks of pain and vomiting after eating. Improvement under treatment but relapse when she returned to work.

A. P. Francine (3) in his summary of the cases



G K Patterson (9) One case Boy age tw 1 e years and eight months Illness began with pain in the epigastric region, continued for seven days then a severe attack of pain in the abdomen with pain in the left shoulder also Vomiting and symptoms of peritonitis Operation Perforated gastric ulcer found on the anterior wall of the stomach about 1 o inches from the middle of the lesser curvature Peritonium washed out drainage Lung complications

Also cites the following case reported by B rhus and Sunne (44) Female thirteen years old Dyspeptic symptoms and vomiting Death from perforation of an ulcer on the lesser curvature of the stomach

J Rexhebt (45) report one case boy age eight years For some years vomiting and constipation For year burning pain in the stomach and vomiting after eating Fracturation Death after repeated severe attacks of pain and vomiting Autopsy showed an ulcer with sharp edges the stomach empty also the pylorus in the lesser curvature perforated A second ulcer on the posterior wall at the pylorus base formed by adhesion of the pylorus

J A Robinson (46) reports one case male age fourteen ill for about one year Pain in the epigastrium vomiting of mucus and blood vomiting becoming more and more frequent and the pulse becoming nervous and macerated Rest and dietetic treatment Temporary improvement but still eating solid food on one occasion oozed bright red blood After that progression a failure of careful treatment and rectal feeding Death Autopsy showed ulcer at the pylorus The lining of the stomach was fibrous tissue the stomach was contracted and the pylorus was constricted

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## POST-OPERATIVE PLEURISY WITH EFFUSION AND EMPHYSEMA

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**P**LEURISY with effusion and emphysema may complicate any infection and as a general rule their incidence varies directly as the severity of the infection. There is, however, a limited group of cases in which the complication occurs after infective processes in the upper abdomen. That the infection in the abdomen may be and usually is the cause of the pleural effusion—the infection often if not always extending either through the lymph channel or by direct tissue continuity—is apparently not sufficiently well recognized.

Many of the textbooks make little note of the coincidence of abdominal and pleural infection merely stating that pleurisy with effusion and emphysema may complicate infection in any part of the body. On the other hand (see and flard) emphasize the association of the two conditions and insist that emphysema in the thorax should always arouse suspicion of subphrenic abscess or gastriculoduodenal ulcer. It was this statement together with recent fatal case of post-operative emphysema seen by the writer which led to the study of the records of the Presbyterian Hospital in order to determine the incidence and comparative severity of these complications.

To quote further from Ge and flard: pleurisy often secondary to inflammation beneath the diaphragm and may occur either with or without the formation of subphrenic abscess. The primary disease may remain latent or may yield only insignificant symptoms. Pleuritic effusion following abdominal infection may be a purulent than serous. They give the brief abdominal conditions which deserve mention in the order of their frequency in the following:

- (a) Gastriculoduodenal ulcers
- (b) Hepatic abscess
- (c) Splenic infarct
- (d) Appendix abscess

(e) After operations upon the stomach and intestines

**Incidence.** During the period tabulated there were 11,013 operations. Following these operation dry pleurisy occurred 45 times, pleurisy with serous effusion 14 times and emphysema 6 times. Some of the more important operation and the case incidence were as follows:

operation	total cases	number of cases	percentage
Gastric and duodenal ulcers, removed or excised, and/or anastomosis	79	12	15.2%
Gastric and duodenal ulcers, removed or excised, and/or anastomosis	66	10	15.2%

In the twenty cases upon which this record is based eighteen followed acute abdominal infection and two followed operation upon other parts of the body. Six cases of emphysema followed laparotomy for infective processes in the abdomen. In four cases emphysema and subphrenic abscess were associated. Hilbergell in 1903 in an analysis of 3,900 abdominal operations found pleurisy with effusion in 16 cases and emphysema in 14 cases. According to his statistics complications referable to the respiratory system are expected after 7 per cent of all abdominal operation and ten per cent of these respiratory complications are pleural effusion, either serous or purulent. Lumpy ma complicated one laparotomy in every three hundred. Unfortunately the figures for the total laparotomies during the period under consideration are not available but the incidence in America would probably be considerably lower than Hilbergell found in Germany. This is possibly accounted for by the fact that a large percentage of the operative cases in Germany are so-called py cases. In other words the acute appendix and ruptured duodenal ulcer are not seen at a fairly high percentage in the foreign hospital as is the case here.

Of the cases of perforated gastric and

In the preparation of this paper cases of spontaneous pleurisy following operations on the thorax were not included in the report.

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duodenal ulcer two were associated with subphrenic abscess and empyema. That this relationship is a definite one, and that the presence of any one of the triad should arouse suspicion of one or both of the others is shown by the report of the following case which while not strictly post-operative empyema (and consequently not included in the table of cases) is typical of the condition under consideration.

D. B. age 44. Appendix removed another hospital ten months before. Condition of appendix unknown.

February 3. Sudden onset of abdominal pain referred to right hypochondrium so vomiting marked distention.

February 16. Right chest tapped 90 ccm slight ly turbid serum extreme tympanites.

March 1. Five hundred ccm bloody serum from right chest.

March 1. Pneumothorax definite. Gradually increasing fluid in right chest marked distention in right hypochondrium. Exploration of chest shows fluid pus. Admitted to hospital. Temperature 100 pulse 80 respiration 60. Thoracotomy allows discharge of larger amount of fluid pus. Smears and cultures show streptococci staphylococci and coliform bacilli.

March 6. There was slight improvement after operation. Temperature not above 100 pulse 80 to 120 respiration labored. Air hunger developed on fourth day after operation and patient gradually became weaker and died 11 days.

Autopsy. Shows old appendix stump and liver abdomen normal in appearance. In the right quadrant there is a large abscess between the right lobe of the liver and the diaphragm. There is duodenal ulcer which adherent to the liver and which shows perforation into the subphrenic space.

Diagnosis. Duodenal ulcer subphrenic abscess empyema.

This patient was seen by several consultants who felt that the main difficulty was above the diaphragm. The course of events must have been Duodenal ulcer perforation subphrenic abscess empyema.

This route is probably the usual one following an abdominal operation although there is no doubt that in a few cases the empyema may occur without abscess formation beneath the diaphragm.

Age and sex. All the cases occurred in adults. The youngest patient was 23 and the oldest 72. Five cases occurred in the third decade and eight in the fourth. There

Case	Post-operative		Pleural Effusion		
	Temp	Duration	Onset	Temp	Duration
1	100	5 days	24th day	101	8 days
2	100	1 day	24th day	102	4 days
3	100	1 day	24th day	101	4 days
4	100	1 day	24th day	101	4 days
5	100	1 day	24th day	101	4 days
6	100	1 day	24th day	101	4 days
7	100	1 day	24th day	101	4 days
8	100	1 day	24th day	101	4 days
9	100	1 day	24th day	101	4 days
10	100	1 day	24th day	101	4 days
11	100	1 day	24th day	101	4 days
12	100	1 day	24th day	101	4 days
13	100	1 day	24th day	101	4 days
14	100	1 day	24th day	101	4 days

Explanation of table. Case refers to the number given each case and is the same number used in large table. Temperature refers in each case to the highest temperature. Duration refers in each case to the duration of the fever. Onset refers to the day after operation.

were only six cases in patients 40 or older. Sex apparently had little influence twelve cases occurring in women and eight in men. This difference in a small series is not significant.

For convenience the two types of effusion may be discussed separately although it should be emphasized that the distinction is not a definite one some cases which begin as a serous exudate going on to suppuration.

**Pleurisy with serous exudate.** Fourteen cases are found under this heading six of which were mild with signs of only a moderate amount of fluid. Ten cases followed laparotomy in eight of which the operation was performed for a true suppurative abdominal conditions associated with local or general peritonitis. Two cases (Cases 5 and 7) were presumably clean cases but one of these (Case 7) had a post-operative temperature which lasted fifteen days and which was as high as 103 at times. One case followed nephrotomy for nephrolithiasis, with infection and abdominal symptoms. The other three were cases in which there was apparently little or no infection and no abdominal symptoms.

From these facts, it is apparent that pleurisy with effusion following operation is most common after acute abdominal conditions associated with peritonitis, but that it may occur after other operations and after those in which there are no signs of peritonitis.



Fig. 6. Case N. 7. Photomicrograph of section from eroded internal condyle showing character of the soft tissue in proximity to the bone. Proliferation of medullary fat with lymphocytes, proliferation of fibroblasts, congestion of blood vessels and few giant cells.  $\times 80$ .



Fig. 7. Case N. 7. Photomicrograph of section from shaft of femur near area of contact with mass, showing dilatation and engorgement of blood vessels, small hemorrhages into perivascular tissues, disintegration and erosion of bone trabeculae.  $\times 80$ .



Fig. 8. Case N. 7. Photomicrograph of section from periphery of lesion adherent to synovial membrane of knee-joint. Not fibrosis of membrane and few giant cells in vascular granulation tissue.

In other words, they are foreign body giant cells that take up or dispose of the debris and debris due to previous tissue destruction.

The term giant-cell growth as applied is therefore a misnomer. The lesion is a hemorrhagic granulation tissue over-growth due to an inflammatory process.

Dr Bloodgood in his review in *Progressive Medicine* for December 9, 3 states in part as follows:

"The term medullary giant-cell tumor expresses the exact finding, and it would be a mistake and misleading to drop the now well established terminology giant-cell, for these lesions."

In the same review in discussing Case 2 of Mathews of New York, who uses the British term myeloma, he states: "It is a typical giant cell tumor" and, further on, remarks as

fluid shows bacteria present, Murphy a plan of injecting 2 per cent formaldehyde in glycerine should be carried out. The prognosis of pleurisy with effusion is fairly good. Of fourteen cases, one died, one was lost sight of while the temperature was still 101 and the remainder recovered. Six cases recovered without any special treatment and the remaining six were aspirated from one to three times. The duration of the illness is always uncertain, the time of convalescence being considerably increased because of the complication. One case left the hospital on the eighteenth day but the average stay in the hospital was much longer (thirty-five days) and one patient (Case 4) who refused aspiration still had a daily temperature of 101 when she left the hospital, fifty-nine days after her operation.

#### TABLE OF CASES OF POST-OPERATIVE PLEURISY WITH EFFUSION

CASE 1. Male age 55. Operation, excision of hemorrhoids pleural effusion, right side. Day of onset, 9. Temperature, 101. Operation, none result, recovered.

CASE 2. Male age 58. Operation, amputation of thigh pleural effusion, right side. Day of onset, 8. Temperature, 101. Operation, none result, recovered. Remarks: sarcoma of thigh.

CASE 3. Male, age 46. Operation, laparotomy for peritoneal abscess pleural effusion, right side. Day of onset, 1. Temperature, 101. Operation, none result, recovered.

CASE 4. Female age 3. Operation, appendectomy, subperitoneal drainage pleural effusion, right side. Day of onset, 7. Temperature, 101. Operation, refused. Result, ( ) Remarks: diffuse peritonitis, home against advice.

CASE 5. Female age 8. Operation, appendectomy without drainage for acute appendicitis pleural effusion, right side. Day of onset, 7. Temperature, 101. Operation, none result, recovered.

CASE 6. Female age 30. Operation, laparotomy for ruptured ectopic pleural effusion, right side. Day of onset, 7. Temperature, 101. Operation, none result, recovered.

CASE 7. Female age 3. Operation, repair of lacerated perineum pleural effusion, right side. Day of onset, 1. Temperature, 101. Operation, none result, recovered. Remarks: tuberculosis (?)

CASE 8. Female age 4. Operation, appendectomy for appendicitis pleural effusion, right side. Day of onset, 7. Operation, aspiration, fluid, serous, sterile result, recovered. Remarks: fecal fistula—secondary abscess opened on fourteenth day.

CASE 9. Female age 57. Operation, cholecystectomy, drainage pleural effusion, right side. Day of onset, 7. Temperature, 101. Operation, aspiration—eight ounces, bluish fluid, serous result, recovered.

CASE 10. Female age 73. Cholecystectomy, drainage pleural effusion, right side. Day of onset, 4. Temperature, 101. Operation, aspiration, fluid, serous. Remarks: died on the twenty-second day—no autopsy.

CASE 11. Male age 35. Operation, laparotomy for pancreatic abscess pleural effusion, left side. Day of onset, ante-operation, temperature, 101. Operation, aspiration on fourth day and twenty-third day, fluid, sterile result, recovered. Remarks: signs of fluid on admission, sixteen ounces, clear fluid on fourth day, and eighteen ounces, bloody fluid on twenty-third day.

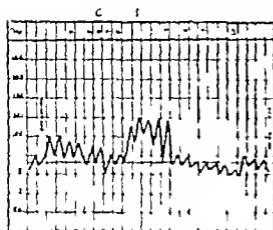
CASE 12. Male age 1. Operation, left nephrotomy for stone pleural effusion, left side. Day of onset, 3. Temperature, 101. Operation, aspiration, twenty-eight and thirty-ninth day, a total of fifty-four ounces, fluid, serous, sterile result, recovered. Remarks: few ribs at left base, discharge.

CASE 13. Male age 3. Operation, appendectomy, drainage pleural effusion, right side. Day of onset, 1. Temperature, 101. Operation, aspiration on fifteen ounces on twenty-second day and two ounces on the twenty-eighth day, fluid, serous result, recovered.

CASE 14. Female age 30. Operation, appendectomy, cut pyelitis pleural effusion, right side. Day of onset, 8. Temperature, 101. Operation, aspiration of ten ounces on twenty-fourth day and twenty-two ounces on thirty-seventh day, fluid, serous result, recovered. Remarks: culture of fluid showed large spore-bearing bacilli.

#### POST-OPERATIVE EMPYEMA

In this condition we have to deal with an extremely serious and an exceedingly fatal condition. I wish to call attention to the beginning to the fact that in six cases of empyema following operation there was not a single recovery. I have incomplete records of several other cases occurring in private practice and in other hospitals, the most salient characteristic of which is the fatal issue. There can be no doubt that cases have occurred with recovery, but the cases cited here are convincing evidence of an extremely high mortality. At the outset I want to emphasize the fact that these cases are not merely terminal infections but in most cases gave symptoms many days before death and as a rule the pleural suppuration seemed the main foci of infection and the



The relation of tuberculous to the condition is no clearer than it is in so-called idiopathic pleurisy. In the absence of autopsies reports it is hard to prove that there was no tuberculous present but finally there were no signs of it except in two cases and even in these the signs were indolent.

If the pleurisy in these cases due to the same infectious agent as the original disease it would follow that in most cases the post-operative temperature and the temperature of the pleurisy would be either continuous or one would follow the other with only a short interval of normal temperature. This relation is shown in the table on preceding page.

From the study of this table we see that in nine cases temperature due to the pleurisy was either continuous with post-operative temperature or occurred after a lapse of less than forty-eight hours. In two cases temperature was normal for a considerable period before the onset of the pleurisy. Of these two cases two were erythema (average duration four and one-half days) and the fifth was only moderate severity (duration sixteen days). In six cases the pleurisy occurred without any period of normal temperature (of these one died) the average duration of temperature due to the pleurisy being twenty-nine days.

The symptoms of post-operative pleurisy were those of pleurisy with effusion from whatever cause. Pain usually occurred in

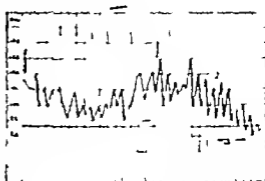


Chart 12. In a patient who died of post-operative pleurisy.

the chest affected and it often preceded the fever by one or two days. In some cases, however, the pain was absent and the rise in temperature was the first indication of a complication. Fever was always present running from 100.5° in the mildest cases to 104° or higher in the severest cases. It was usually the remittent type. In every case even in those in which the temperature was continuous, there was a distinct rise of temperature with the onset of the pleurisy. The accompanying chart illustrates the temperature variation in a mild case and in a moderately severe case of pleural effusion following operation for emphysema resection. As a general rule this type of pleurisy occurs most often on the right side indicating that the inflammation spread by direct extension. In two cases the pleurisy was left-sided and in both the original focus was a lesion in the left half of the abdomen.

The leucocyte count in uncomplicated post-operative pleurisy with effusion is usually moderately increased and there is often a slight increase in the polymuclear cells. The average count in uncomplicated cases was 13,600 with 73 per cent polymuclear cells.

The treatment of the milder cases should be expectant only. If the signs of fluid are marked and persistent the chest should be aspirated and the operation repeated as may be necessary. On theoretical grounds, hexamethylbenzamine should be given in large doses for its anti-septic effect on the fluid present. In cases where the culture of the

lients died shortly after operations for the relief of accumulations of pus, and in two cases thoracotomy was not performed. It is difficult from such a series to say anything regarding treatment. These patients have already one serious lesion to combat, and it is exactly those cases in which the abdominal lesion is severe that are associated with empyema. However some patients rally well after the abdominal operation, only to succumb to pleural (and possibly also subdiaphragmatic) infection. Shall the pleura be opened immediately upon the discovery of turbid fluid in the chest or shall we wait for adhesions to form? I have seen such a case opened early and the respiratory difficulty from the resulting pneumothorax has seemed to be of more importance than the toxemia due to the infection. Further study may demonstrate a more satisfactory method of dealing with this condition. The case histories of six cases of post-operative empyema referred to in this paper are given herewith.

**CASE 15.** B. B. age 3. Patient comes under treatment for stomach trouble which she has had for many years. Two days before there was sudden sharp abdominal pain and marked prostration. Abdomen showed signs of diffuse peritonitis with shifting dullness in both flanks.

September 8. Median laparotomy showed large amount of free pus in peritoneal cavity. Because of bad condition cause of inflammation was not searched for but wound closed with drainage. Examination of pus showed bacillus coli communis and many yeast cells.

September 24. Drainage has been profuse. Temperature irregular between 100 and 103 signs of dry pleurisy in left side to-day.

September 27. Signs of fluid in left chest aspiration gives 600 ccm slightly turbid yellow fluid.

October. Temperature has continued, but has been a little lower. General condition has been unsatisfactory but better than admission. Bowels moved by catharsis, only slight discharge from abdominal wound. Thoracotomy large amount of brownish pus.

October 3. Some improvement since last operation. Free drainage. Little clear fluid in right chest.

November. Condition not so good cough troublesome small amount of fluid in right chest.

November. Temperature has been a little higher and patient has been growing steadily weaker. There have been no signs in abdomen, no tenderness over liver or other signs pointing to local accumulation of pus. Patient died suddenly to-day.

**Autopsy.** Perforated gastric ulcer of lesser curvature large subphrenic abscess perisplenic abscess, chronic tuberculosis of both apices empyema small septic abscess in liver and lung.

**CASE 6.** M. A. age 6. Patient well until one and a half years ago, when he had fever and chills for several days, and has not felt entirely well at any time since. For two weeks had sticking pains in the right side. Physical examination shows moderate prostration temperature 100.5 pulse, 80. The right upper quadrant seems full with slight bulging. No rigidity and tenderness in same area. X-ray shows liver enlarged downward. Lungs are clear.

January 7. Operation incision and drainage of liver abscess culture showed streptococci.

February 1. Septic temperature only slight discharge from wound.

February. Exploratory laparotomy drainage of perirectal abscess.

February. Incision into substance of liver revealed a cavity the size of an egg containing small amount of pus.

February 8. Only slight drainage from incision septic temperature continues rectal examination and blood cultures negative.

March 20. Twenty-two ounces of turbid fluid aspirated from right chest temperature higher — 105°.

March 28. Aspiration of chest, 8 ounces general condition much worse.

March 29. Thoracotomy with escape of large amount of turbid fluid exploration of subphrenic space also large amount of pus.

May 6. Condition has been about the same. To-day he developed acute abdominal symptoms and abscess was found in the left upper quadrant. Patient did not rally after the operation.

**Diagnosis.** Abscess of liver subphrenic abscess empyema and perirectal abscess.

**CASE 7.** J. D. age 35. Onset of illness four months before with vomiting. Dull pain in left side and left flank for three months worse for past week. Fever and chills at irregular intervals for last two months.

March 3. Examined. Shows prominence of left upper abdomen with rigidity and tenderness.

**Operation.** A large subphrenic abscess, opened and drained. Cavity appears to be chiefly on left side.

April 20. Seven ounces of reddish amber fluid aspirated from left chest temperature continues.

May 4. Temperature has been high — 104° but recently it has been about 101°. Chest opened to-day under cocaine.

May 20. Patient has been growing weaker died suddenly to-day.

**Diagnosis.** Subphrenic abscess empyema.

**CASE 8.** L. L. age 38. Patient gives history of acute illness lasting only four days. Acute abdominal pain and tenderness, associated with vomiting.

October 7. Physical examination. Shows

direct cause of death. The cause of the pleural infection is easily seen by a glance at the table. Every case followed laparotomy and in each case the lesion was associated with peritonitis either local or general. In four cases the original lesion was situated in the upper half of the abdomen and in two of these patients the infection started as a perforated ulcer either gastric or duodenal.

From the above it is apparent that empyema is common following perforation and that signs in the right chest following the repair of a perforated ulcer should always lead to the immediate exploration of the pleural cavity and *vice versa* in cases of idiopathic empyema in adults a most careful examination of the abdomen should be made to exclude the possibility of infection beneath the diaphragm. I have already cited a case in which the pleural condition was mistakenly considered the primary lesion and in the table (Case 20) there is an example of a case in which the diagnosis of pyopneumothorax was not made during life. In the presence of either of these two conditions the possibility of their coexistence always demand serious consideration.

The third member of the group subphrenic abscess apparently has a definite relation to the others also and its occurrence should always lead to the suspicion of either or both the others. In the 15 cases under consideration subphrenic abscess was present in four absent in one and doubtful in one in other words if one may judge from six cases we may expect to find subphrenic abscess in two third of the cases of post operative empyema. In three cases the abscess was demonstrated during life and in one case (No. 15) there were at all times no signs referable to the abdominal cavity autopsy revealed a large subphrenic abscess containing almost a pint of foul smelling pus.

The absence of pain, cough and other symptoms referable to the chest should be especially noted. It is possible to have an acute empyema with the accumulation of large quantities of pus in the pleural sac without any symptom which would direct attention to the chest. On the other hand general symptoms were always present. The temperature following operation might fall

to normal and then slowly rise again with the progress of the thoracic infection. The usual course is for the temperature to continue but on a generally lower level until the onset of the empyema then slowly rising again it often reaches 103 or 104 and continues at about this level often with septic remissions until shortly before death when it usually either reaches 105 to 107 or falls to normal or subnormal. The cases all occurred in adults between 26 and 56 and the majority of these cases were females.

The result of the exploration was especially interesting. In two cases the effusion was apparently purulent from the start in two other cases the fluid was turbid and in the fifth case it was reddish amber. This contrasts strikingly with the cases of pleurisy with effusion in which the fluid was always clear straw color and remained so throughout the course of the disease. Is there a period during which the effusion in these cases is serous and does it only become purulent after it has become infected? This question cannot be answered but it seems to me that the statement is justified that if the exploration of the chest in cases of this type results in a turbid exudate the process will probably go on to pus formation and that furthermore the presence of a clear sterile exudate in most cases favorable to the recovery of the patient.

Cultures of pus from the chest in post operative empyema usually resulted in a number of different organisms. This in itself points to direct extension of the inflammatory process for when an organism is carried by the blood to distant portion of the body it is usually present in pure culture. In one case the examination of the fluid showed many yeast cells which presumably were spread from the stomach by means of the perforated ulcer and direct extension. Tuberculosis was definitely present in only one case and in this patient the process was a chronic one and apparently in no way responsible for the fatal issue.

The prognosis is bad no case recovered. One patient lived ninety nine days after the first operation and thirty seven days after thoriotomy had been performed. Two pa-

4. In so far as they refer to post-operative conditions, Gee and Harder's statement that pleural effusion following abdominal infection is more often purulent than serous is not borne out by case records.

5. There is a distinct clinical type of empyema which may complicate abdominal infections either before or after operation, and the case mortality of this type is very high.

6. The relationship which exists between perforated gastric ulcer, subphrenic abscess, and empyema is exceedingly close and the

occurrence of one of these conditions, without apparent cause, should lead to a suspicion of one or both of the others.

7. A turbid or purulent effusion occurring in the right chest, following laparotomy requires immediate drainage and should lead at once to the exploration of the subphrenic space.

NOTE.—I wish to acknowledge herewith my indebtedness to the attending staff of the Presbyterian Hospital for their courtesy in granting permission to study and report these cases.

## INTESTINAL OBSTRUCTION DUE TO CANCER OF THE COLON

WITH A NOTE ON THE OPERATIVE TREATMENT OF THIS CONDITION

By ALEXIUS McGLANNAN, M. D. BALTIMORE

INTESTINAL obstruction due to cancer of the colon may be either acute or chronic, occurring as the symptom of onset of the malignant disease or as a development during its course. In addition to these forms there is the post-operative acute obstruction which may occur after removal of the tumor or an operation designed for palliation.

In the series of 98 cases studied for this paper 61 have an obstruction of some sort in their pre-operative histories. In 33 the tumor was found to be operable and 13 patients were cured. An obstruction therefore, is a little more likely to occur in the course of a curable than an incurable tumor and has this value in prognosis.

The position of the tumor in each of the groups is shown in the table.

An acute obstruction occurred as the symptom of onset in ten cases. Seven were operable tumors, of which number four were cured and three died, one from the toxemia of obstruction, one from embolism, and one from a post-operative obstruction. Three patients had inoperable tumors, one of whom is still living two years after the removal of the tumor and the accessible metastatic glands.

Occurring during the course of the disease

an acute obstruction is found in 20 cases. Of these fourteen were operable tumors, four are cured, five died from the toxemia of the obstruction, one from an acute dilatation of the stomach coming on four days after the complete removal of the tumor, two from shock, one from embolism seventy days after the removal of the tumor, and one from peritonitis nine days after the resection and anastomosis.

Chronic obstruction as the initial symptom

TABLE SHOWING ULTIMATE RESULTS ACCORDING TO THE LOCATION OF THE TUMOR

Location of tumor	Obstructive Group			Non-obstructive Group		
	Cured	Operable Unable Living	Dead	Cured	Operable Unable Living	Dead
Cecum			10	3		8
Appendix						
Ascending and Ileocecal						8
Transverse						
Sigmoid and Descending						
Sigmoid						
Sigmoid						
Multiple						
Total				7		24

marked protrusion. Abdomen generally distended with tenderness and rigidity over all, but little more marked in the right lower quadrant. *Operation.* Shows gangrenous appendix with a diffuse purulent exudate. Appendectomy and drainage.

November 13. Temperature went to above operation condition at first was very bad but recently little better. Fecal fistula healed after operation, but stopped on sixteenth day.

November 14. Chest placed in dry and about 100 ccs foul-smelling pus removed.

November 15. Died suddenly 11 a.m.  
Diagnosis: Acute suppurative peritonitis with general peritoneal empyema.

Case 10. Mrs. C. age 35. For 3 days has had intolerant gastric symptoms burning pain in epigastrium after eating. Acute onset on day of admission. The patient vomited and had no stool. Lateral abdominal tenderness and rigidity on whole abdomen, more marked in right upper quadrant. Diarrhea in right flank.

December 1. *Operation.* On day of onset had perforated duodenal ulcer with stomach contents free in abdomen. Ulcer 1/2 inch and 1/4 inch in size and perforation 1/4 inch. Drainage of peritoneal cavity and subphrenic space.

December 6. Temperature remained below 100 for first four days. A little higher (101.5) after two of best 1 day and 7 ccs of thick yellow pus removed.

December 7. Thoracotomy with removal of about 3 ounces of thick yellow pus.

December 8. Temperature has been rising at times. Free discharge from chest lower wound practically healed.

January 10. *Operation.* How large subphrenic abscess with about one pint of pus between the liver and diaphragm. Following operation patient condition grew gradually worse and she died only four hours later.

Diagnosis: Duodenal ulcer perforation empyema subphrenic abscess.

Case 11. Mrs. A. M. age 4. For 10 weeks before admission has had attacks of diarrhea and vomiting constipation in the morning no fever or chills. On admission bowels relaxed and stool 1/2 inch from anus. On admission tip of tongue hard and tongue coated. *Operation.* October 1905. Colostomy. Condition after operation poor temperature rose to 101.5 after operation but fell to normal in three days.

November 4. Patient has vomited frequently since operation no evidence of return of fecal matter. Food is kept in stomach at night by suction. Temperature has been normal.

December 5. Temperature has reached 102 or 103 daily. Patient vomits a profuse quantity of very bad pus. Cough and expectoration of pus in right chest slight cough in left chest perforation. Died suddenly 11 a.m.

Autopsy: Stricture of rectum pyoperitonitis, right (there are no signs of peritonitis or of a subphrenic abscess).

## RESULTS OF FIRST OPERATIVE EMPYEMA

Case 15. Female age 3. *Operation.* Laparotomy for diffuse peritonitis pleural effusion left right sides. Day of onset 6 temperature 103. *Operation.* operation on ninth day thoracotomy on left second day. Day 11 chest post result died. Remarks: perforated gastric ulcer subphrenic abscess tuberculosis died fifty-third day autopsy.

Case 16. Male age 16. *Operation.* incision and drainage of liver abscess pleural effusion right side. Day of onset 44 temperature 101.5. *Operation.* operation of abscesses fifty-third day. 3 abscesses on 15 first day and thoracotomy on sixty-second day. Result: died. Remarks: subphrenic abscess and peritoneal abscess died thirty-fifth day.

Case 17. Male age 33. *Operation.* incision and drainage of subphrenic abscess pleural effusion left side. Day of onset 13 temperature 103. *Operation.* operation on twelfth day thoracotomy on fortieth day. Result: died. Remarks: subphrenic abscess died fifty-first day.

Case 18. Female age 38. *Operation.* appendectomy for abscess pleural effusion right side. Day of onset 23 temperature 103. *Operation.* aspirate of two abscesses on eighth day. Result: died. Remarks: local abscess died twenty-sixth day — no autopsy.

Case 19. Female age 16. *Operation.* Laparotomy for perforated duodenal ulcer pleural effusion right side. Day of onset 6 temperature 103. *Operation.* operation of abscesses with day thoracotomy on seventh day. Result: died. Remarks: subphrenic abscess opened on the tenth day fourth day died on the twelfth day.

Case 20. Female age 4. *Operation.* colostomy for intestinal obstruction pleural effusion right side. Day of onset 11 temperature 103. *Operation.* none result died. Remarks: autopsy showed pyoperitonitis and benign structure of rectum died twenty-first day.

## CONCLUSION

From the study of the above cases we are justified in concluding that —

1. Pleural effusion is not of uncommon occurrence after operations and may occur at any time but is most often seen before or shortly after the subsidence of the post-operative temperature.

2. It is most frequently seen after septic abdominal conditions, and is usually on the right side.

3. A clear serous exudate in right chest is not necessarily a serious complication, such cases usually going on to recovery.

this barrier fibrous trabeculae extend into the epithelial masses, forming a more or less dense stroma. The mass of epithelial cells permeates the coats of the bowel as a globular mass with an encroachment on the lumen until it reaches the peritoneum when the connective tissue reaction becomes manifest in the formation of adhesions. It is at this point that the tumor cells enter the lymphatics and metastasis to glands and distant organs occurs. The extent of adhesions therefore and particularly the relation of this extent to the size of the tumor becomes a measure of the relative malignancy of the tumor.

Extension by infiltration is the more frequent method of growth and may be either intra or interglandular. The former is relatively rare and in this variety the proliferating cells extend over or under the surface of the mucous membrane or through the submucous coat. In morphology and staining characteristics the cells are changed very slightly from the normal.

Interglandular infiltration is the common form of growth the extension occurring through the lymph vessels. These vessels tend to form four groups: those of the mucous, the submucous, the muscular and the subperitoneal coats. The mucosa group begins high up in the spaces of the mucous membrane and coming down through the periglandular reach the subglandular lymphatics situated on the medial side of the muscular masses. These subglandular vessels are united to those of the submucosa by wide channels and these in turn go in a perpendicular direction to join the muscular and subperitoneal groups.

The infiltrating cancer-cell therefore may grow horizontally along the peri and subglandular lymphatics forming a tubular mass or out in the perpendicular channels to reach the submucous groups, in which event a narrow annular mass will be formed. Very often a combination of both forms occurs and frequently the expansive form of extension is also present, so that a combination of the nodular tubular and annular tumor results.

Having reached the subperitoneal lymphatics the malignant cells next stimulate the connective-tissue reaction in their vicinity

with resulting adhesions between the tumor and surrounding viscera and the abdominal walls.

In adenocarcinoma the variety most often associated with obstruction the mass is hard, elastic, and nodular with occasional areas of softening from necrosis. On opening the bowel the tumor is quite definitely separated from the healthy mucous membrane by a very hard edge raised above its surface. Below the tumor the colon is normal or its wall is shrunken. Above the wall is changed to a greater or less extent depending on the degree and duration of the stasis produced by the tumor. This change varies from a simple hypertrophy of the muscularis to an extreme dilatation with paralyzed flabby, oedematous and friable walls. The disturbed nutrition of the walls with the bacterial decomposition of the intestinal contents soon gives rise to a severe toxemia which becomes fatal unless promptly relieved by operation.

Oedema of the mucous membrane above the tumor is almost constantly present and a rapid intensification of this oedema is the commonest cause of the acute obstruction occurring in the clinical course of these tumors.

Ulceration is common: a superficial shallow ulcer is most frequent but the necrosis may form a perforating ulcer causing local or general peritonitis, a perforation into another viscus (for example a pathological anastomosis) or an intermuscular abscess.

In carcinoma solidum, the late form of tumor the mass is hard, often showing fine lobulations and ulceration usually with perforation. Some stenoses will be present with its compensatory hypertrophy or resulting dilatation.

Vesicles of clear acid gelatinous material shining out in various parts of the rather soft tumor characterize the gelatinous or colloid form of carcinoma of the colon. The soft masses of peritoneal metastases occurring in this colloid form of carcinoma solidum may be confused with tuberculous of this membrane.

Histologically carcinoma of the colon is divided into three varieties, according to the character of the epithelial cells and their arrangement. The third form seems to be the

occurred in ten cases. Four are cured, one patient whose tumor was felt to be inoperable is living one and one half years after a short circuiting operation. Nine were operated upon because of this symptom alone but three of the cured case came to operation on account of an acute obstruction developing during the course of the disease. Of the remaining six were operated upon on account of the persistent obstruction or an alternating chronic obstruction and diarrhea. Three had operable tumors, and two died from post operative obstruction. In one case the operation was the incision of an abscess of the lumbar region due to infection of the muscles by the perforation of an infiltrating tumor.

Chronic obstruction during the course of the disease is noted in twenty seven cases. Twenty two patients were operated upon on account of the persistent chronic obstruction either with or without some operability. Symptoms five patients are cured and four in whom the tumor was found inoperable are living. Two of these are short circuited, one has a stomy and while the fourth patient was freed after simple proctectomy.

Among the fatal cases eight patients had operable tumor, four died before operative obstruction was relieved and one died of distant tumor of the stomach one of procarcinoma and in one case the history is incomplete and the cause of death uncertain.

Of the thirty seven unobstructed cases six are cured. The other had operable tumor but failed as an immediate result of the operation of peritonitis resulting from a leaking uterus. Sixty patient who had inoperable tumors at the time of operation are living. In twelve of these short circuiting was done four were simply explored in one a stomy was performed. Sixteen are dead—a direct result of the inoperable tumor.

In both series we have patient whose tumors were operable but who died as a result of some accident or complication following the operation and a second group in which the patient are living although the tumor was inoperable at the time of the operation. Omitting these cases from the series we have thirty two in which obstruc-

tion occurred of whom thirteen recovered (forty per cent) and twenty two non-obstructive of whom it recovered (twenty seven per cent). If we add the cured case in the first group these patients who died from the symptoms of obstruction because of delay in operating and who therefore might reasonably have been expected to recover had they been relieved earlier we add six cases and have sixty per cent possible cures.

Herein lies the symptom of obstruction as a symptom of cancer of the colon and prompt operation for the relief of this symptom, at least if of the utmost importance in advancing the possibility of cure for the patient.

Biologically carcinoma of the colon is generally one of low grade malignancy. The tumor grows slowly and has a strong tendency to be circumscribed in the extent of its invasion of the bowel. Metastases develop slowly and are seldom present until after the tumor has given fairly distinct warning of its presence. These warnings are obstruction, acute or chronic alternating diarrhea and constipation, blood and mucus in the stool, progressive loss of weight and a sense of fullness or spasm in the bowel. The obstruction is generally an obstruction rather than a strangulation for which reason these patients often have little or no toxemia. The abdominal pain is visible or palpable, spasmodic and the symptom of the compensatory stage of obstruction lasting for many days with little or no toxemia.

Intestinal adhesion may cause volvulus, intussusception, or an acute obstruction by a band but these strangulations are unusual.

The gross pathology shows the tumor invading the bowel as a nodular mass as a tubular or annular infiltration, or what is most frequent a combination of these forms. The tumor may begin as a polypus. In the beginning there is no alteration of the surface of the mucous membrane and no distention or ulcer is found.

In the growth of the tumor the malignant cells advance either by extension or by infiltration. In the former case the epithelial cells form a compact mass which is definitely circumscribed by a fibrous reaction on the part of the invaded connective tissue. From

follows. If we leave out the predominant cell, the giant-cell, we have a tissue resembling vascular granulation tissue."

It seems to the writer that the presence of granulation tissue in a lesion is the best evidence one can obtain of inflammation. As the giant-cells are simply phagocytes and add to the evidence of a present low-grade inflammatory process, the term giant-cell tumor does not seem to express the exact finding the lesion presents.

The term tumor as now applied always suggests a neoplastic autonomous growth.

Much more misleading however is the title sarcoma. As these lesions are not malignant, the term is a misnomer.

Regarding an already well-established terminology—that is, giant-cell—it seems rather pertinent to recall that the term rheumatism was long an established one for the arthritides which we now recognize as being inexact and incorrect. Scrofula until recent years was an established term for glandular tuberculosis, and there are many other long established names that have fallen by the wayside.

The writer suggests that the term hemorrhagic osteomyelitis conveys more exactly the nature of the existing conditions these various localized traumatic lesions present, and at once places them in their proper classification with the inflammations.

From the foregoing considerations the writer desires to emphasize the following:

1 The so-called medullary giant cell sarcoma of bone is in fact a localized regenerative inflammatory lesion, without evidence of malignancy.

2 Owing to the anatomical arrangement and structures involved slight initial trauma is ample to account for the pathologic phenomena and progressive bone destruction that occurs, regardless of any infective process.

3 The giant-cells found in these lesions are neither tumor-cells nor tissue builders. They act in the capacity of scavengers.

4 A more simple terminology and classification is needed. The terms at present in use are numerous confusing and misleading.

The following cases are presented as being typical of the lesion under consideration.

**CASE 1** W. W. male white, age eleven years. Injury to leg and sprain of ankle two years ago. No trouble observed until one year ago. Since then has noticed that whenever he got tired the leg pained him.

**Exam. notes.** Boy well nourished and healthy looking. Tender spot on anterior border of lower third of left tibia. Deep pressure causes pain. X-ray (Fig. 1) shows an area size of a marble apparently cystic in character. No other lesion. Wassermann negative.

**Operation.** Bone chiseled down to involved area, and hemorrhagic granular tissue removed. No sign of fibrous structure or lining membrane. Inner bony wall smooth.

**Microscopic examination.** Loose edematous and moderately vascular granulation tissue. A few well-defined multinucleated giant-cells of the foreign body type are seen scattered throughout the tissue. No histologic evidence of malignancy.

**Diagnosis.** Hemorrhagic osteomyelitis.  
**CASE 2** P. Ulme D. W. female age six years.  
**Later report.** Returned for treatment, February 1913. Wassermann negative. Von Pirquet negative.  
**Operation.** Removal of cystic fibrous structure (no fluid) and lining membrane from bone cavity in acromial end of right ulna the size of a cherry.

**Microscopic examination.** Inflammatory fibrous tissue.

**Diagnosis.** Chronic fibrocystic osteomyelitis.  
**CASE 3** Harry F. K. male white age 14 years. Injury about right buttock, one year ago. Pain and tenderness since treated at three hospitals for hysteria.

**Examination.** Localized tenderness and pain on deep pressure over right ilium near sacro iliac joint. X-ray (Fig. 3) shows focus size of a five-cent piece, just external to right sacro iliac joint. Wassermann negative.

**Operation.** Saucer-shaped fibrous tissue focus removed containing multiple worm-eaten looking spots (cysts).

**Microscopic examination.** Inflammatory fibrous tissue.

**Diagnosis.** Chronic fibrocystic osteomyelitis.  
**CASE 4** J. N. male white age seventeen years. In M. O. 3 was struck on the right wrist with a baseball some pain following injury.

For last six months more or less pain in wrist, but stops for two or three days, and then returns. Several attacks of severe pain during past month. X-ray (Fig. 4) taken one week ago. Clinical and X-ray pictures negative as to tuberculosis or syphilis.  
**Clinical and X-ray diagnosis.** Chronic hemorrhagic osteomyelitis. Operation refused.

**CASE 5** Max S. male white age sixteen years. For past four months feeling of discomfort in upper third of right leg. Tenderness over head of fibula. Deep pressure causes pain. No history of injury. X-ray (Fig. 5) shows focus size of large coffee bean. Clinical and X-ray picture negative for

The clinical history and X-ray pictures of this case were reported in Ann Surg Phila. 1911, February 1514.



Fig. 1. Carcinoma glandularis Colae. Tumor of sigmoid flexure. Obstruction is usual. Photomicrograph by Schapiro.

end result of the growth of the first two, while the second is apparently a metamorphosis occurring in the first variety when the vigor of the malignant growth of the epithelium is markedly greater than the resistance of the reaction on the part of the connective tissue.

The first variety, adenocarcinoma cylindricum, is most frequently found in the obstructive cases (42 of the 61 cases in this series). The tumor cell is cylindrical epithelium, only slightly changed from the normal cells of the mucous membrane. The proliferation begins in the fundus of the glands with a piling up of several rows of cancer cells which soon form an atypical glandular mass beneath the basement membrane. A simultaneous connective tissue reaction forms a protective barrier separating the tumor from the surrounding healthy tissue and sending strands into the epithelial masses as they grow. The glandular arrangement is preserved in the extensions of the tumor in the wall of the bowel and is reproduced in the metastases. The latter occur quite late in the disease in these tumors where the cell retain the cylindrical form.

In certain tumors proliferation of epithelium goes on to form solid tubes rather than take the ordinary glandular form. At the same time the type of cell changes from the cylindrical to a flat polygonal cell with a large deeply staining nucleus that is a cell of the same type as the cuboid cell of the epidermis. The tumor therefore is called adeno-

carcinoma cubocellulare. The connective tissue reaction is slight and the barrier is insignificant. The epithelial cells grow rapidly with abundant mitoses and, quickly permeating the bowel wall, form widespread metastases to lymph glands and distant organs. This variety of tumor is more commonly non-obstructive and has brought about the death of the patient in each of the seventeen cases in which it was present in this series.

The third variety, carcinoma solidum, is the end product of the local growth of the first two. It is not a measure of the duration of the tumor but considered in relation to the duration, the presence of this form is rather an indication of the degree of malignancy of the tumor.

The cells are flat oval, or polygonal and are found in large solid masses in a scanty fibrous stroma—the medullary or alveolar tumor, or in small epithelial areas in a considerable stroma—the sclerous or diffuse form.

Metastases to lymph glands or distant organs are nearly always present with this third variety of tumor and make the prognosis practically hopeless.

**Carcinoma gelatinosum.** Many of the tumors of all varieties have goblet cells containing gelatinous or mucoid material with the cylindrical or cuboid ones. A preponderance of the mucoid cells gives the tumor a softer consistency while its relative malignancy is controlled by the presence or absence of the cuboid cell. In addition to the usual routes of extension tumors of this type show a marked tendency to spread on the serous coat of the bowel and form diffuse metastases on the peritoneum.

In planning the treatment of the obstructive form of tumor we must arrange for the relief of the obstruction and combat its toxins. Should this exist? At the same time the operability of the tumor must be determined and this fact with the method for its removal be kept in mind while arranging for the immediate relief of the obstruction.

The method chosen therefore must vary within quite wide limits. For the sake of easy reference I will describe first the findings

at exploration which determine the operable or inoperable nature of the tumor. These are

*First* Extensive firm adhesions between the tumor and adjoining loops of intestine or other viscera and especially between the tumor and the lateral and posterior wall of the abdomen. Adhesion to other loops is not necessarily a sign of inoperability provided the excision of the tumor and the adherent coil is technically possible. In one case of this series a sigmoid cancer involved a loop of ileum in its growth. The entire mass was removed and the patient is living and well three years after the operation.

*Second* Metastases to the peritoneum, liver, other portions of the intestine and to the retroperitoneal glands. The route of metastasis may be indicated in a fairly definite way according to the localization of the tumor. Those of the caecum give metastasis to the mesocolon, stomach, small intestine and to the supraclavicular glands, but do not involve the liver or pancreas. Tumors of the hepatic flexure reach the liver as well as the stomach and the supraclavicular gland. Sigmoid tumors are especially likely to have metastases to the liver.

*Third* Involvement of other viscera or the abdominal wall by a direct extension of the tumor.

*Fourth* Involvement of the great vessels, especially the inferior vena cava, by the growth of the tumor.

According to the condition of the patient at the time of operation we may make the following groups:

*1.* Acute obstruction with toxicosis, no localizing symptom. That is, a patient who shows only the symptom of acute obstruction without a mass, visible or palpable, or without local tenderness or other signs indicating the position of the obstruction. In such cases laparotomy should be made immediately and local anesthetic and immediate intestinal operation performed. The position of the tumor and the operation will depend largely on the history of the tumor. With an operable tumor it is better to have the enterostomy through a wound in the side of the abdomen opposite the location of the tumor. This



Fig. 1. (Tumor) acellular. Tumor of sigmoid colon. Obstruction. Photomicrograph by Schipper.

make it possible to remove the tumor at a later date through a clean field not encumbered by a lesion about the enterostomy. Whenever possible the caecum is the best place for the opening. The bowel should be opened at once and a tube inserted.

The toxemia may be combated by subcutaneous salt solution given in large quantity slowly through one or two small caliber needles, adding adrenalin if the blood pressure greatly lowered. The stomach should be washed out and a toral oil poured in through the tube after the lavage. When the tumor is situated a distance from the enterostomy, for example in the sigmoid with a colostomy opening, the impaction of the colon will continue the toxic symptom after the small intestine has been emptied. For such cases warm oil given by the drop method through a catheter into the enterostomy will soften the masses which will be expelled either through the wound or by the anus. After the obstructive symptom and the toxemia have disappeared the tumor may be attacked as described under the chronic obstruction.

Should the exploration prove the tumor inoperable the colon should be opened immediately in the most convenient place for the artificial anus until it is felt that a further incising incisions around the tumor could be done later. In the latter case the final incision should be opened across the abdomen. The same rule applies when the patient has a chronic symptom in addition to those of acute obstruction.

2 Chronic obstruction. Here there is not the urgent need of relief required by the patients in the first group. Localizing symptoms may be sought for and one of the most valuable of these is the X-ray picture after the administration of bismuth by enema or by mouth. Having determined the probable seat of the tumor in such a case the abdomen is opened in the most convenient place for exploration and one of several methods are then available for the treatment of the tumor.

#### Operable tumors

(a) Resection and anastomosis. When the patient is in good physical condition without toxemia or anemia and the bowel empty removal of the tumor and immediate restoration of the continuity of the bowels is possible. This operation is the most satisfactory because at a single chance we are able to cure the patient. Unfortunately few patients come to us in condition for this operation. The lateral anastomosis is the method of choice and when both segments are of the large intestine, the anastomosis described by Bloodgood should be used. In this method the closed ends are brought side to side, a thumb may be approximated and are then anastomosed. The turned-in ends are sutured outside the peritoneum. Leakage which is most likely to result from imperfect circulation of these ends then forms a superficial fistula instead of a peritonitis.

Among the operable tumors in this series four patients died of peritonitis from leakage at the site of the anastomosis. The thumb method was not used in any of these fatal cases.

(b) Resection and anastomosis, bringing the open ends of the segments out of the abdomen. Impaction of the bowel above the resection with subsequent fatal post-operative obstruction from this cause occurred in one operable case treated by resection and anastomosis. Such a disaster may be avoided as may also the danger from laughing of the ends of the segment by making the anastomosis as usual but instead of closing the divided end, bringing them to the skin surface and closing the wound around them.

In this way we provide free exit for the bowel contents above the anastomosis as long as this may be required and having already completed the removal of the tumor and the anastomosis we make the closure of the fistula a simple procedure.

The method has an advantage over that of anastomosis with enterostomy above the suture in that it drains the lowest portion of the bowel that in which impaction is most dangerous.

(c) The protrusion operation. This method is especially useful when dealing with anemic patients in whom relief of obstruction by enterostomy has not improved the general condition. Toxemia from the tumor continues to depress the nutrition while the condition of the patient makes an extensive operation impossible and at the same time renders the process of healing less certain. In such cases the surgeon is confronted with the necessity of operating and the dangers of shock and sloughing.

In the protrusion operation the ends supplying the area to be removed are ligated and the mesentery divided, the tumor with the lymphatic glands is delivered through the abdominal wall and the peritoneum closed. After forty-eight hours the bowel is divided by the cautery, no anesthetic being required, and the patient left with a double enterostomy. Later the spur between the loops of the enterostomy is divided by pressure of the enterotroche.

A modification of this protrusion makes the lateral anastomosis before delivering the tumor. After the bowel is divided in this modification, the patient is in the same condition as after the operation (b). The great advantage of the protrusion operation lies in the speed with which it may be performed and the entire freedom from soiling of the peritoneum and from danger on account of imperfect circulation in the ends of the bowel. It has an advantage over the preliminary short circuiting in that the abdomen is opened but once and the risk and annoyance of dealing with post-operative adhesions is avoided.

For the irreducible tumor we have two operations.

1 Short-circuiting that is, a lateral anastomosis of a loop of bowel above with one below the tumor. In this way a new route is opened for the passage of feces and the obstruction is overcome. This short-circuiting may be combined with enterostomy above the anastomosis for the relief of toxemia or better with a temporary opening near the tumor in order to give egress to the accumulation immediately above it.

2 Colostomy. In some tumors especially those of the sigmoid it is impossible to do a short-circuiting operation. For such patients a colostomy is the only recourse. The bowel may be divided above the tumor and the end brought out of the wound or the loop may be sutured to the abdominal wall and opened laterally. If the bowel be divided the lower segment is closed and inverted while the upper one is brought through and under the rectus muscle much as is the stomach in a Sabanajew Frank gastrotomy or when this is impracticable the segment of colon is twisted around its long axis half a circle and then brought through the muscle.

The after care of the colostomy patient may add a great deal to his comfort or misery. A dressing that will prevent leakage of

feces and escape of gas is a valuable aid to these patients. Such a dressing is described by W. W. Keen. A dummy truss is the key to the situation with this dressing but all the details are important for its success.

More recently a simple obturator has been described. This consists of a finger cot fixed over the end of a small catheter and wound loosely with a thin layer of gauze. This is inserted into the colostomy so that its tip is well inside the abdominal wall. The finger cot is then distended by air pumped into it through the catheter, the latter clamped and a water and air tight obturator is the result. When it is desired to remove the plug the air is allowed to escape. The gauze wrapping prevents the rubber slipping out of the opening.

Careful regulation of the diet and regularity in emptying the bowel by enemas, with the use of one of these methods of dressing the colostomy will overcome many of its annoyances. This is most important because these patients are apt to live a long time and proper management of the artificial anus gives them great comfort.

## STRICTURES OF THE GALL-BLADDER

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**A**LTHOUGH the urgency of the gall-bladder is well developed yet strictures of the gall bladder have not received the study and consideration which they deserve.

Longitudinal septa have been described as being of congenital origin but transverse strictures and septa have been usually regarded as being acquired. Morton reports a case in which there was a septum at the junction of the middle and lower thirds of the gall bladder obstructing the lumen so completely that the opening could not be found with a probe. There were fifty stones lying in the sac distal to the obstruction and sixty-five in the proximal sac. Morton regarded the septum as being of congenital origin, but other authors have doubted this because the presence of the stones is believed to bear evidence of infection present. Moynihan speaks of deformities of the gall bladder without going into details as to their character or origin. Many references are to be found to the so called hour glass contraction.

This study was undertaken in order to determine first the frequency of strictures of the gall bladder second, their characteristics third, the different etiological factors entering into their development and fourth their clinical significance.

This report is based upon the study of 1100 gall bladders made while the author was serving as a volunteer assistant in the Pathological Institute of the University of Vienna. The gall bladders are all from post mortem examinations.

After the liver had been removed the gall bladder was carefully inspected. Then with careful pressure of the hand upon the proximal end the bile was forced into the distal end, distending it in order that deformities might be better seen. The proximal end was then distended in the same manner by pressure upon the distal end. The gall-

bladder was now removed from the liver and each end again distended by pressure upon the opposite end as before. This method of examining the gall bladder is important, as otherwise many strictures would be overlooked.

Some of the gall bladders were now opened and inspected and then fixed and sectioned for microscopic study. In others the bile was expelled by pressure and a mixture of melted wax and paraffin injected through the cystic duct. Following the injection the gall bladder was suspended in the icebox or in running water to harden, after which it was split and removed leaving a perfect cast of the lumen.

Of the eleven hundred gall-bladders studied one hundred were in babies varying in age from the seventh month of intra uterine life to one month after birth the majority however were in those dying within the first forty eight hours after birth. Sixteen were between one month and twenty one years of age and nine hundred and eighty-four were twenty-one years of age or over.

In sixty two consecutive post mortems upon babies, seven strictures were found that is, in 11.29 per cent. Four of the strictures were in the middle portion of the gall bladder and three were at the upper end. In this connection it must be remembered that congenital deformities are more frequent in the babies dying early than in those that survive, so that this does not mean that strictures are present in 11.29 per cent of babies who live. In one hundred and thirty four consecutive examinations upon those twenty one years of age or over strictures were found in 17 cases or in 12.7 per cent.

Strictures of the gall bladder may be either congenital or acquired. In the past, as previously stated, they have been regarded as being of acquired origin only by most observers, but that many of them are congenital is proved by the fact that they are found in the very young babies. Cast No. 1

was made from the gall bladder of a baby dying within twenty four hours of birth (Fig 1). Cast No 2 is from a child two years old (Fig 2). In this case the distal end of the gall-bladder was buried in the liver so that the deformity was not seen until the gall-bladder had been dissected out. The specimen (Fig 3) which I exhibit is from a child twenty months of age at death.

Uncomplicated congenital strictures in adults can be distinguished by the fact that there is an absence of the evidences of inflammation and by the fact that the characteristics of the congenital strictures differ from those of the acquired type. It is, however often difficult to differentiate from acquired strictures, congenital strictures in which changes have taken place due to an infection and gall-stone formation. Congenital strictures predispose to infection and gall stone formation and these in turn to ulceration and scar formation.

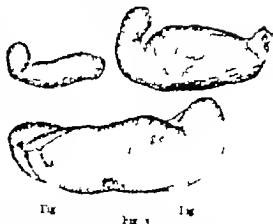


Fig 1 Congenital elbow deformity in child day old (Cast)  
 Fig 2 Congenital elbow deformity in child two years old. The distal end of the gall bladder was buried in the liver (Cast)  
 Fig 3 Congenital elbow deformity in child 20 months old (Gall bladder fixed in Kummert's solution distended with air)

Congenital strictures are of three types  
 1. Annular strictures  
 2. Those due to the projection of folds of the inner layers into the lumen. These usually occur in conjunction with the first or third type but sometimes occur independently. These properly speaking are septa but I have classified them here owing to their obstructing the lumen.  
 3. The fundus structure or elbow deformity in which the fundus is folded upon the body of the gall bladder.

The annular strictures extend entirely around the gall bladder but they do not produce the marked interference with the lumen seen in the elbow deformity. When the gall bladder is not distended a stricture of the annular type may not be perceptible, but upon distention either by compressing one end as previously described or by the injection of fluid into the gall-bladder it is brought out. Sometimes there is a fold of the inner layers of the gall bladder projecting into the lumen. This fold may involve the whole circumference of the gall bladder along the line of stricture or only a portion of it.

Structures, or more properly speaking, diminution in the size of the lumen due to folds of the inner layers, may occur in con-

junction with the annular strictures as just described, or in conjunction with the elbow deformity to be described shortly or independent of either (Fig 4). Such a fold may take its origin from a narrow base extending entirely around the gall bladder on a line perpendicular to the axis of the gall-bladder or from only a portion of such a line. The folds do not take their origin from a short base but instead the mucous membrane is continuous for the whole length of the flap. In other words, the folds are rarely or never pedunculated, but instead the base of the fold is usually longer than the margin. There are some cases however in which the flap is attached for the entire circumference of the gall bladder the opening being rarely in the center but more or less eccentric.

These folds may be so small as to be easily overlooked, or so extensive as to produce a complete obstruction—as seen in one of my cases in which there was a small sac at the upper end completely separated from the gall-bladder and containing a mucous fluid not stained with bile. In addition to the septum producing the complete obstruction there was a narrow transverse, shelf like projection near the middle of the gall bladder. A case with a complete obstruction as in this

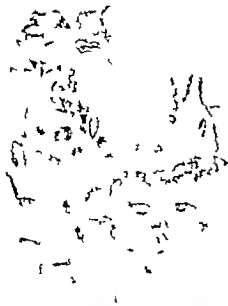


Fig. 4. Cross section of transverse duct like projection extending into the gall bladder. Muscular folds in the center. Peritoneum detached as result of post mortem change.

case has been described by Dévé. These folds are made up of the mucous and muscular coats when small (Fig. 4) but when extensive may contain a central fibrous layer.

The elbow deformity or third type is the most common congenital stricture (Figs 5, 7, 8 and 9). In this condition there is a bending of the fundus upon the gall bladder together with a diminution in the size of the lumen by a fold similar to that described in the second type of stricture. The outer coats of the gall bladder appear too short for the inner coats and in place of dipping down into the fissure pass directly over so that in some cases without careful inspection one might overlook the deformity (Fig. 5). The serosa passes over the under surface of the gall bladder like a sac. In the subserosa may be found bands of connective tissue extending from the proximal portion of the gall bladder to the distal acting as guy ropes to maintain the deformity. The fibrous layer may pass over but usually dips down into the fold, in which case there are connective tissue bands passing across the fissure from one side to the other (Fig. 6).

In one such case as this I carefully cut the serosa, subserosa and these connecting bands, permitting the distal portion to straighten out but a narrowing of the lumen was still present.

The fold extending into the lumen is usually made up of the three inner coats folded upon themselves in such a manner that there are two layers of each with the mucosa on the outside and the fibrosa on the inside with the muscularis between. Usually the fibrous layers are fused together as one and in case of absence of the fibrous layer the two layers of muscularis are fused. The mucous membrane of each side is continuous with that of the gall bladder of the respective sides throughout the entire length of the fold. This fold or septum always obstructs the lumen to quite an extent and in some cases it produces almost a complete obstruction.

The way in which this deformity occurs is not difficult to understand when it is remembered that the three inner coats—mucosa, muscularis, and fibrosa—differ in origin from the two outer—the serosa and the subserosa. At first the gall bladder has only the three inner coats. It develops in comparatively a straight line. Later the peritoneum fuses to the under surface giving this surface its two outer coats. In the cases of the elbow deformity the fundus, either because of a too early fusing to it of the peritoneum or due to its meeting an obstruction, becomes folded downward upon the gall bladder. In these cases when the peritoneum fuses to the under surface it does not extend into the crevice but instead passes directly over making the deformity become permanent.

Acquired strictures vary from those producing practically no perceptible obstruction to the lumen to those which produce almost complete obstruction. They may arise from

1. Destructive lesions beginning with the mucosa
2. Intramural infection
3. Pathological processes beginning with the serosa
4. Adhesions
5. Chronic inflammatory processes
6. Perforating wounds
- Malignant tumors

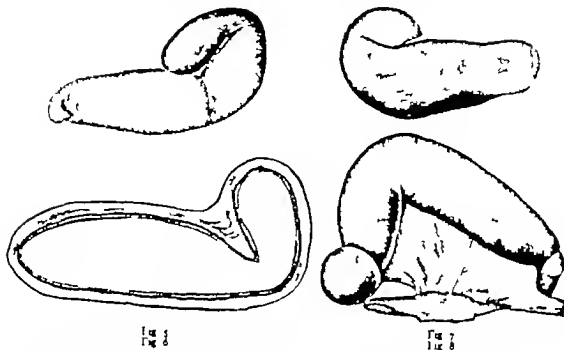


Fig. 5 Double congenital elbow deformity of the gall bladder. The peritoneum extended over the deformity so that it is scarcely visible.

Fig. 6 Schematic drawing of elbow deformity. Inner three layers involved in deformity outer two pressing over.

Fig. 7 Congenital elbow deformity of gall bladder (Cast).

Fig. 8 This gall bladder above elbow deformity and has well-developed mesentery. Drawing made from specimen in the museum of the Pathological Institute of the University of Prague through the kindness of Prof. Dr. Gohn and Privat Dozent Dr. Roman.

The destructive lesions beginning in the mucosa belong usually to one of the two types, the one in which the necrosis of tissue is due to the action of bacteria or their toxins. This forms a very frequent cause of ulcer and in some cases they are very extensive. In one of my cases there was a marked stricture about four centimeters from the fundus. On opening the gall bladder a fold was found at this place diminishing the lumen to about one fourth that below the stricture. A large scar was present upon the upper surface of the septum and another below involving a large portion of the surface of the gall bladder. In all, over one-half of the inner surface was occupied by the scars. No stones were present.

In the other type of this first variety of acquired strictures the preceding ulcer begins as the result of pressure necrosis from stones. The pressure necrosis together with the resulting infection may not produce as

extensive an ulcer as the first type but it often produces a deeper ulcer and one that more often leads to perforation.

Ulcers of the gall-bladder when superficial, may heal without deformity but in the majority of cases there is some deformity which may vary from a slight constriction to the typical hour-glass contraction (Fig. 10) in which the lumen may be almost completely obstructed.

The second form of acquired stricture results from intramural infections originating either from infected Luschka ducts or from bacteria or infected emboli brought through the cystic artery. I shall deal more extensively with the infections of Luschka's ducts in a future paper.

Strictures due to lesions beginning on the serosa are by no means rare. The pathological process may be a part of a general peritonitis or a local peritonitis arising from any one of the numerous causes.

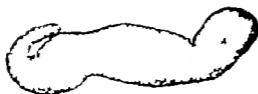


Fig 9

Fig 9. The proximal stricture is acquired, the distal one congenital. The gall bladder was filled with black stones the size of an onion seed. (Cast.)



Fig 10

Fig 10. Hour glass contraction following an ulcer. Large fold of mucous membrane extending into the gall bladder. (Cast.)

Those cases of stricture in which adhesions exist between the gall bladder and other organs or the abdominal wall are grouped under the fourth class. Sometimes connective-tissue bands are seen extending cross-wise producing constriction of the gall bladder. Sometimes as in one of my cases there was a newly formed membrane similar to the so-called Jackson's membrane covering the gall bladder.

Chronic indurative processes are responsible for strictures as well as for shrunken or so-called atrophic gall bladders.

Under perforating wounds are included strictures resulting from operation, gunshot wounds, stab wounds, etc.

Malignant strictures are usually carcinomatous but I saw one case in which there was a developing metastatic melanosisarcoma in the gall-bladder wall.

#### CLINICAL SIGNIFICANCE

That strictures of the gall bladder have a clinical importance can be easily seen by the study of post mortem material. Acquired strictures interfere with the proper drainage and hence serve to harbor infections as well

as aid in stone formation. Congenital strictures so long as infection does not occur are of but little clinical significance, but when infection does take place they have the same importance as the acquired.

Strictures particularly those of the acquired type may serve as etiological factors in the development of carcinoma.

In operating the gall-bladder should be studied carefully for strictures, for if not recognized it may be that when the opening in the gall bladder heals the contraction of the scar tissue will make the lumen through the stricture smaller than before, so that in place of helping the patient he will be made worse. Further in the elbow deformities, if the condition be not recognized, not only may the stricture be made smaller as just mentioned but the gall-bladder may not be properly closed and the bile may leak into the peritoneal cavity.

In conclusion I wish to thank Hofrat Professor Dr. Weichselbaum for placing the material at my disposal and Professor Dr. Oskar Stoerk for the opportunity of working in his laboratory and for the many suggestions he made.

## INVERSION OF THE UTERUS

B MICHAEL J BUCK M D PITTSBURGH

IT does not often fall to the lot of one to meet two cases of inversion of the uterus. The comparative rarity of the accident naturally elicits an interest from the profession. What makes these two cases of especial interest is to know that they both bore children after the repair of the accident.

I think it well to give a description of my work, and then to refer to work of a similar character especially that of Kehrer who probably antedates all others in this particular operation a full description of which is described by Peterson.

**CASE 1.** Age 34 at the time of birth of second child at full term. On removal of the placenta the fundus of the uterus came down with the after birth and was clamped in the doubled over cervix so tightly that the attendant physician was unable to reduce it. Calling to him and a consultant together they made an effort under complete anesthesia to restore the uterus to its normal position but were not successful. October 8, 1900, six months after this episode the patient was sent to me for the purpose of having a hysterectomy performed for relief from the continual bleeding as they expressed it. I found the patient very much wasted, so much so that I had given up as to the outcome of the case yet I could see no chance of bettering her condition by delaying the operation.

On the morning of the operation I ordered salin per rectum in 6 ounces and hypodermoclysis of one pint under each breast. After this the anesthetic was used which he responded very kindly. After thorough cleansing of the part the gloves and fingers were inserted and immediately I met obstructing mass about the size of a large range of the most oval of any mass bleeding from the internal surface and by putting my finger on it with the double tenaculum forceps, holding the fundus I passed my finger up surveying the body. The finger met no contact with the culled or doubled mass which grasped the external body of the uterus. It was about the size of a duck's testis.

(After 10 minutes) Grasping the cervix with the tenaculum I made an incision between them beginning at the cervix and extending through the vault of the vagina into the pelvic cavity. When the incision was prolonged low through the neck and body of the uterus the fundus along the tensor of all of the organs of the upper part of the time the fundus of the uterus

was in the grasp of a double tenaculum and pulled back towards the rectum in a state of extreme retroflexion, while the cervix was grasped by two tenaculum forceps one at either margin of the incision and held by an assistant who also had control of the retractor in front. On completion of the incision the order of things was reversed the uterus was placed in position of complete anteversion and the two tenacula that grasped the margins of the cervix incisions were brought down and back of the body of the uterus and crossed so that the one on the right pulled over to the left and vice versa. By this means the cervix incision was held together which minimized the loss of blood from the uterine arteries till the sutures could be placed. Now the uterus was, so to speak, folded upon itself back into place a double row of catgut sutures were inserted and the walls brought together commencing at the junction of the body and the cervix. A difficulty was encountered in bringing the two margins into apposition and in completing close union. When the body and fundus were repaired the uterus was replaced within the peritoneal cavity through the longitudinal opening in the left and front wall of the vagina. Having accomplished this the remaining sutures necessary to bring the os together and to close the vault of the vagina were inserted. The patient came off the table but little the worse for the shock and slight loss of blood. The recovery was rapid and complete.

The history of Case 2 differs, in the main, but little from that of the first except that she was operated upon nine months after the injury and recovery was as good as the first. The patient referred to in Case 1 gave birth to four children and patient Case 2 to two children, subsequent to the operations.

I want to recall one thing to your notice in which my operation differed from the Kehrer and that was in the transverse incision in the vault of the vagina which he made use of while in these two cases I simply made the longitudinal incision. I extended the incision upwards in order to give me sufficient space to return the uterine body into the peritoneal cavity when it was repaired. One might think it difficult to complete the cervix repairs but when the uterus was repaired and returned to its position I found no difficulty in inserting the sutures in the cervix by the aid of the tenacula that brought the

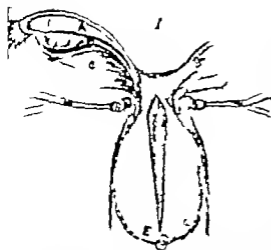


Fig. 1. Shows the inverted uterus with incision from cervix to fundus as made by three tenaculae, one at either side of the cervix and one to the fundus. Shows the con- cavity above, here broad ligament and appendages are pulled down. A, fallopian tube; B, ovary; C, broad ligament; D, cervix; E, fundus.

margins together and retained them until the sutures were tied. You will notice that in neither instance did I find it necessary to chip out the wedge shaped piece in order to lessen the resistance of the walls. This may have been accounted for by the recentness of the accident, the oldest being but nine months. I can readily understand that where an accident has been several years old the tissues become more firm, have less resiliency and may require the removal of the wedge shaped piece as was done by Kehrer to approximate the two surfaces snugly.

Up to the date of the above operations (1902) I had known nothing of Kehrer's work in this particular line, hence I was not governed by any lines or methods indicated by others or I probably would have made the transverse incision in the vagina and no doubt would have been tempted to do so if I had encountered any serious difficulty in returning the body of the uterus to its normal position within the peritoneal cavity. As it was I did not find any occasion to cross the incision. I found very material aid in having the assistant grasp the margins with tenacula and hold them in apposition until the sutures were tied.

I think it a mistake to take too deep a bite into the tissues with the needle, likewise less resistance will be encountered if the stitches are not passed too near the lining of the uterus, say about two-thirds of the thickness of the wall is sufficient.

To make a very practical illustration of the method of operation, one which I think will make it clear to every one, would be to take a rubber glove and invert one of the fingers. The hand or glove proper represents the vagina, and the inverted finger the uterus. Now on looking into the glove which represents the vagina, one sees the inverted finger representing the inverted uterus. On turning back the cuff or glove proper and making an incision along the anterior wall of the inverted finger and then turning it as if it were inside out, stitching it together again on the posterior surface and then replacing it by up-ending it, one may readily understand the various steps of the operation.

Some considerable conjecture as to the exact cause of inversion leads me to speak of a case I saw with a very competent obstetrician a few hours after the accident, and where reduction was accomplished under anesthesia without incising the uterus. This lady had had a rapid and easy delivery before the doctor entered the house, and no traction was made on the placenta because it came away unaided, yet this woman had a much lacerated os, which may have been responsible for the descent of the fundus, and this probably facilitated the tardy reduction also.

The original operators made an abdominal incision, and by tamponade with one hand in the abdomen and the other in the vagina attempted reduction, unfortunately with very indifferent success. Brown made an incision through the uterus posteriorly and dilated the os through the incision with some better results. Kustner incised the uterus posteriorly and Kehrer was probably the first one who attempted to make the incision anteriorly. With our present knowledge and experience one is at a loss to know why any one should have selected the less accessible and more difficult route posteriorly unless it may have been through fear of injuring the bladder. In Case 1 I entertained this feeling, hence I

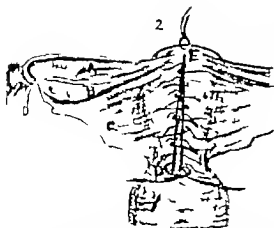


Fig. 2. Showing the uterus turned over and the tenacula or hooks pulling together the wound with the sutures inserted ready to tie. A fallopian tube B ovary C broad ligament D cervix E fundus.

filled the bladder with eight ounces of saline in order that I might more readily detect its outline and thereby keep it out of harm's way, but I found this unnecessary in Case 2 because my knife was directed away from the bladder all the time. In fact, I cannot understand how one could injure the wall of the bladder as long as the cutting edge of the knife is directed back towards the uterus.

A matter that impressed me was that one is likely to err on the side of discretion by not making the incision long enough that is not down to the fundus and in attempting to turn over the uterus upon itself and unite it in its normal position meet with great resistance which might tear the uterine tissue if the incision were too much slanted. It is much better to make a free incision and avoid the use of force or any violence and by the use of a few artery forceps all hemorrhage can be held in check until the bleeding points can be ligated or grasped by the sutures. I first attempted to turn the uterus over through an incision of the cervix extending down about two-thirds of the way through the uterus by

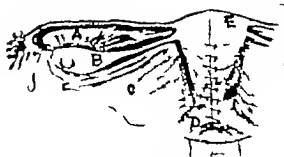


Fig. 3. The uterus repaired with sutures inserted and tied. A fallopian tube B ovary C, broad ligament D cervix E fundus.

the use of the index fingers inside the uterine wall and pressing the thumbs up against the fundus, and while I think I might have succeeded I believe it better practice to elongate the incision down to the fundus. After doing this I found it quite easy to adjust the organ, insert the sutures, and bring the two margins of the wound into apposition.

The appended sketches will serve to show roughly the successive steps of the operation. Fig. 1 shows the inverted uterus with the incision extending through the cervix and down to the fundus. Fig. 2 shows the uterus turned over and the sutures inserted. Fig. 3 shows the incision united by the sutures. Notice in Fig. 1 the relation which the uterus bears to the vagina—upside down, so to speak, and the os folded upon itself which is due to the resistance offered by the broad and round ligaments to a complete inversion. In Fig. 2 the uterus, being turned upon itself shows the corrected position with the incision gaping open and the sutures inserted and ready to tie. In Fig. 3 you will observe that all the sutures have been tied and the edges snugly approximated. Here you will notice the advantage of crossing the tenacula and pulling the right margin to the left and the left margin to the right until the knots of the sutures have been securely fastened.

tuberculous Wassermann negative (This is the only case of the series in which a history of trauma has not been elicited. It is also the earliest case observed.) Operation refused.

*Clinical and X-ray diagnosis:* Chronic hemorrhagic osteomyelitis.

**CASE 6.** M. B. female, white, age twenty-three years. Injury ten years ago. Never has suffered from pain. Tenderness on deep pressure. Leg uniformly enlarged in its upper third. Thinks leg has slowly increased in size. Causes no discomfort. X-ray (Fig. 6) shows circumscribed lesion and the deep shadows show hemorrhagic structure. Wassermann negative.

*Clinical and X-ray diagnosis:* Chronic hemorrhagic osteomyelitis.

**CASE 7.** H. S. male, white, age sixty-three years. Apparent age seventy-three years. Foreign born married four children. Four years ago injured right knee. Immediate pain and swelling. Laid in bed two weeks. Aspiration and removal of a table spoonful of tarry fluid. Two months following injury X-ray (Fig. 9) was taken. Three months after onset of injury resumed occupation as packer and shipper of china. Remained well until two years ago when he fell a distance of twelve feet from the top of a lumber pile, landing same knee. Has limped ever since. December 24, 1913 he slipped on the ice and struck right knee. Had up two weeks. In February, 1914 he was compelled to give up work on account of disability and pain standing or walking. March 19, 1914 began daily bakings of knee for one hour periods continued for five weeks without result. May 19, 1914 knee aspirated, small amount of clear blood removed. From this time motion in joint absent. Patient referred to me August, 1914 for treatment for chronic synovitis.

*Examination:* Lower third of right thigh and knee-joint enlarged (Figs. 7 and 8). Circumference right knee, 7 inches; right thigh (middle) 6 3/4 inches; left knee, 13 1/4 inches; left thigh (middle) 5 inches.

Veins dilated over affected area. Slight redness and heat. Is wearing long brace and using cane. Has no Romberg. Pupils normal. Patellar reflexes sluggish. General arteriosclerotic changes evident. Wassermann negative.

*Clinical diagnosis:* Hemorrhagic osteomyelitis with possible malignant degenerative change.

*X-ray diagnosis:* Central sarcoma (Figs. 9-11).

*Operative diagnosis:* Hemorrhagic osteomyelitis.

*Operation:* Oct. 10, 1914. Vertical incision six inches long, anterior aspect, lower third right thigh. Lesion encountered immediately upon cutting through the edematous soft parts. The anterior bony wall the size of goose egg destroyed. The mass was very hemorrhagic, reddish in color, quite friable, but firm in consistency and with the glistening appearance these lesions usually give to surface was smooth and even with but not bulging through, the bone opening, probably due to the fact that previous to operation tourniquet had been applied.

Due to the patient's enfeebled condition and the evident poor vitality of the edematous soft parts surrounding the lesion, I decided to perform amputation of the thigh in its upper third.

In a younger robust individual, the more prolonged operation of resection, and transplantation, with obliteration of the knee joint (under a similar pathological condition) would be indicated.

#### OBSERVATIONS ON THE PATHOLOGY OF HEMORRHAGIC OSTEOMYELITIS

BY O. S. HILLMAN, M.D.

*Gross pathologic examination:* The lesion is located in the lower extremity of the femur for the most part in the condyles, and presents to view through a jagged oval shaped opening, 9.5 x 7 cm. in the anterior surface of the bone (Fig. 12). The appearance of the lesion in the fresh state is quite striking and has been noted above in connection with the operative findings of the case. Resemblance to vascular granulation tissue in lesions of this type is a feature that has been commented on by several observers. The amount of newly formed tissue is abundant enough to nearly fill a half pint jar was readily dislodged from around the edges of the opening in the bone and also from the presenting surface of the lesion. The mass of tissue remaining in the expanded end of the femur is roughly the size and shape of a clenched fist. After thorough preliminary hardening of the specimen, it was sawed open lengthwise and the full extent of the lesion exposed (Fig. 13). It measures 11 cm. in length and 6.5 cm. in the greatest anteroposterior diameter. Its boundaries are, on the whole, well defined. There is, however, no enveloping connective capsule. Below it is limited by the gouged out internal condyle, articular cartilage, and thickened synovial membrane. At no point has the mass broken through these structures into the knee-joint. Above the line of demarcation from the medulla is plainly visible. As may be seen from Fig. 13 the lesion has eroded the external aspect of the lower end of the femur to a greater extent than it has on the inside where there still remains a rough shell of bone representing what is left of the internal condyle. Externally the lesion is limited by the com-

TABLE 3. Opsonification of spores of sporothrix by patient's serum (normal = 1)

Date	Opsonic extinction at dilution of
July 4	1/96
July 5	1/96
July 6	96
August	384

A serum free mixture of leucocytic suspension of spores and salt solution served as a means of control the dilution of serum in which no more cells engaged in phagocytosis than in the serum free mixture being called the point of opsonic extinction.

Comparative and opsonic agglutination tests were made by Mr McCullough using, as reported in the article cited, the strains of sporothrix and the heated and unheated serums of normal persons of a patient with sporotrichosis of the eye and of rabbits immunized with suspension of sporothrix spores, but in all of them it was impossible to differentiate the various strains of the organisms although the immune sera were readily distinguishable from the normal by their high content of immune bodies.

In a very thorough discussion of sporotrichosis in man Hamburger<sup>1</sup> groups the features which are helpful in the differential diagnosis of sporotrichosis as follows:

**Clinical.** The occurrence in men between the ages of 15 and 45 in the country and farming districts (but also in the cities). The occurrence in farmers, fruit and vegetable dealers, berry pickers, florists, etc. A history of preceding trauma by nails, wire, knife, hammer bites of animals (rat, hen) pan-  
prick, etc.

The slow period of incubation following the initial trauma, the insidious onset and slowly progressing course, the slow ascending infection following the course of the deep lymphatics.

The production of characteristic small, round, hard subcutaneous nodules and their uniform evolution into softened cold abscesses or cutaneous ulcers.

The long-drawn out clinical course of the disease with little or no pain or temperature and little or no effect on the general health.

**Laboratory.** The local and general eosinophilia. The presence of eosinophiles in the initial chancre in the nodules in the pus from broken down nodules and in the blood of experimental animals as well as clinically. It will be of great interest, therefore to see

whether more extended observations will show the eosinophilia to be of diagnostic importance.

The cultivation of the organism on artificial media, the growth of sporotrichum being characterized by its slow initial appearance, its ready growth on two per cent glucose agar at room or incubator temperature, its raised corrugated appearance on slant agar and its radiating flower-like appearance in stab culture, its brownish-black pigment production in old cultures and on four per cent glucose agar, its branching septate mycelium and pear-shaped spores.

The clinical history and the physical examination usually disclose sufficient evidence upon which to base a positive diagnosis of sporotrichosis. From the laboratory side, the cultivation of the organisms on artificial media and the demonstration of immune bodies in the patient's serum appear to be of especial importance. Local and general eosinophilia, judging from its absence in the present case and in the case described by Wilder and McCullough (cited above) is probably an inconstant factor and therefore, unreliable for diagnostic purposes.

The local use of iodine as the tincture or as Lugol's solution, and the administration of potassium iodide internally in large doses is the treatment usually recommended. These measures, especially the iodide by mouth, should be continued until the last vestige of the disease disappears. In advanced or obstinate cases copper sulphate internally in one-eighth gr to one-half gr doses in capsules should be given in conjunction with the iodides. Complete excision of certain of the lesions in the absence of acute exacerbations with demonstrable lymphangitis, appears to be a commendable procedure. The value of vaccination with suspensions of killed spores, and of the X-ray as therapeutic measures, cannot at present be stated, but would seem to be sufficient to justify trial.

The writer wishes to thank Dr Arthur Dean Bevan for permission to describe this case and to express his gratitude to Mr McCullough for the immunological work done.

## REPORT OF A CASE OF SPOROTRICHOSIS

B. BENJAMIN F. DAVIS, Ph.D., M.D., Chicago

Assistant Surgeon, Professor in Surgery, Rush Medical College  
From the Surgical Clinic of Dr. Arthur Dean, Rush Medical College

In June 1913 Mrs. M. F. presented herself at Dr. Bevan's clinic where the following clinical notes and observations were made:

The patient is 27 years of age, was born Belgium, at present resident of Chicago but recently arrived from South Dakota. She comes complaining of several ulcers on the right forearm, of dizziness of the right forearm and hand and of morning vertigo and nausea. About 12 months ago the patient was out in the field pitching hay and a bay needle or cactus needle pierced the skin of the palm of the right hand just proximal to the web between the middle and ring fingers. At the corner of the next two or three weeks a lump formed at the point of injury and became tender and somewhat painful; this lesion has persisted up to the present time. Occasionally it discharges small quantities of blood and serum. A month after the primary injury the hand and forearm became swollen and painful apparently without cause and several red linear streaks were observed on the back of the hand and forearm. This trouble disappeared in a few days only to reappear at intervals for a month when small lump red with bluish edge somewhat painful and tender was noticed on the dorsal surface of the forearm near the external epicondyle of the humerus. This lump gradually increased size, blister formed and it oozed out. Sixteen days later more lumps similar to the first but developed on the forearm and hand between the point of injury and the lesion on the elbow. Some of these discharges were sanguinous, radiating from time to time others have not yet broken down.

General examination disclosed nothing beyond the septic changes in the fairly well preserved portions of the body. Locally there are found the lesions mentioned as occurring on the right hand and forearm. The primary lesion was a crusted papulo-

puscle with bluish red edges, the size of a split pea painless and very slightly tender on pressure. The lesions on the forearm presented the same general characteristics in size they varied from diameter of a few millimeters to that of a quarter-dollar. Temperature was normal.

The blood examination resulted as follows:

Hemoglobin 75 per cent (Dare)  
Leucocytes 9600 per c. mm.

## Differential

Small mononuclears 6 per cent  
Large mononuclears 6 per cent  
Indental leukocytes 2 per cent  
Polymorphonuclear neutrophils per cent  
Polymorphonuclear eosinophils 3 per cent

A diagnosis of sporotrichosis was made, based on the history and clinical findings, and excision of the largest and most active lesions advised. This was done on June 3, 1913 and the wounds closed without drainage. Healing was very slow. The patient was placed on large doses of potassium iodide and when last seen, about six weeks after operation, appeared to be making satisfactory progress.

From the excised lesions a material was glucose and blood agar media. After seven days a typical sporotrich colony appeared in glucose agar slant at room temperature and three days later several similar colonies were observed on blood agar slant at 37 degrees C. The organism was in pure culture in both instances.

Smears from the pus were examined with reference to the proportion of eosinophil leucocytes but none were found.

Parts of the lesions were embedded in celloidin, sectioned and stained with hematoxylin and eosin. Under the microscope these sections presented areas of round cell infiltration of the corium and subcutaneous tissues with in addition, few epithelioid tubercles and occasional giant cells (Langhans type). Marked diffuse thickening of the walls of the arteries was noticed. There were no evidences of local eosinophilia. No organisms were recognized.

Agglutination and opsonic tests were made by Mc Clufford P. McCullough according to the technique described by him about time ago. Only the highest dilution of each agglutination occurred as given in the table.

TABLE Agglutination of sporotrichal spores by patient's serum (normal = 1)

Date	Agglutination	dilution of
July 4	32	
July 5	32	
July 6	32	
August	96	



dread of ether. He feels that every drop of it means an additional risk to his patient and it is partly for this reason that he performs his task with an excessive speed which is not always consistent with the best interests of his client. In the case of a physician requiring surgical treatment it is a common observation to see him shrink not from the operation but from the ether narcosis yet so strong is habit that the majority despite their fears prefer to inhale ether and metaphorically speaking bury their heads in the sand so as not to hear or see anything.

Lest there be a misunderstanding let me state emphatically that this is not an argument for abolishing ether inhalation altogether but a protest against its indiscriminate employment. Neither can it be my purpose to recommend spinal anesthesia as an all-sufficing method of surgical anesthesia for it obviously would be just a bigoted to become wedded to this or indeed any other single method and to forget that not our personal predilection but the need of the individual case alone must govern our choice of an anesthetic.

The German and French literature once so full on the subject now contain but a very few reviews of large series of cases operated upon under spinal anesthesia. This can mean but one thing namely that the value of this procedure has been established beyond a doubt and that the question has been practically settled. In Italy and Russia the interest in the method is increasing to judge from a fairly large number of contributions listed in the *Index Medicus*. From England and British India series of a thousand and more cases are recorded by individual operators. Only in America is the number of reports small and they remain limited almost altogether to the same few men who have practiced and written on spinal anesthesia for years. Yet, from personal observations and private communications I am inclined to think that this method is really more widespread in this country than would seem at first sight and I therefore consider it most appropriate at this time that an authoritative body like the American Gynecological Society should discuss the question, so that

any merely conventional objections may be properly dealt with. But there is another reason why our society is the right forum for this discussion for it should be remembered that it is in the field of gynecological operations that spinal anesthesia is of the very greatest advantage and shows its most impressive results.

It is but natural to anticipate at once a query as to the mortality from spinal anesthesia. Unfortunately here again statistics fall us, as is demonstrated by the wide divergence of the figures reported. While Hohmeier and Kronig computed one death in 200 and Strauss one death in 3500 spinal anesthetics, Thommashewsky recorded one death in 17847 cases (4).

The majority of fatalities occurred a number of years ago when spinal anesthesia was still in its infancy. It is a sad but inevitable fact that in our empirical science, and particularly in surgery every progressive step exacts its toll of human lives. In spinal anesthesia the anesthetic itself has I believe nothing to do with the mortality. The three agents which alone need be considered for clinical purposes—stovaine, tropococaine and novocaine are more or less equivalent. While my personal experience is limited to novocaine spinal anesthesia will be treated in this article without reference to a particular drug.

The safety of spinal anesthesia depends first and foremost on its accurate technique as it has been evolved in the last twelve years. Although the injection into the arachnoidal sac is a very simple procedure the strictest observance of even the most minute detail is of paramount importance. To all who wish to employ spinal anesthesia I earnestly recommend the description of the technique by Sellheim (5) which takes into account every particular step of the method. Thanks to improvements in technique the serious complications of former days have almost altogether disappeared. Death from spinal anesthesia is due to paralysis of the respiratory center in the medulla, caused by the rapid ascent of the anesthetic and this disaster can practically be avoided as attested by the thousands of cases operated

SPINAL ANESTHESIA IN GYNCOLOGY

By CLORCE CLIFORNS M.D. I.A.C.S. SELEW

BRIOR an audience which I thoroughly familiar with the history and technique of spinal anesthesia only the two following questions require discussion. First is there a field for an anesthetic other than the popular ether drop method. Secondly do the results obtained with spinal anesthesia justify its wider application in gynecology.

It may at first seem somewhat of a matter to assert that the security of an operation stands in direct proportion to the amount of ether inhaled but you will only wait a little while to see the surgeon who is giving particular attention to the subject of anesthesia to see a conscious effort throughout to reduce to a harmless minimum the quantity of ether administered. If we turn to the professional anesthetist (I claim this) we hear him propose the slogan "conserve the patient's respiration and warm against that a condition which may unphysiologically occur."

I hardly need turn to this with the anesthetist is sometimes to turn the tide of battle against the new war in medicine. And if still further proof were needed for the proposition that the popular ether anesthesia is not an ideal procedure and therefore not applicable in all cases we have but to recall the multitude of modifications the many inventions of new methods and the numerous combinations of old and new modes of anesthesia which have been proposed within the last ten or fifteen years.

Statistics would quickly settle the question but unfortunately there are no reliable statistics to be had. Next to the lack of accuracy of the figures collected by Crutchever (2). While in Europe one death occurred in 16,302 ether anesthesia in America the proportion was only to 5,623 and neither percentage conclusive. I know personally of several other fatalities that have never found their way into print and into statistics and I am sure that most of you have made similar observation. Nor does the immedi-

ate mortality rate even if it were correct, tell the whole story. If the patient survives the operation itself but dies a few days or weeks later it is at present impossible to state to what extent the anesthesia account should be charged with the fatal outcome but it is not unreasonable to suppose that the anesthetic had something to do with it. The statistics of Peters (3) are at least suggestive in this respect. He studied the causes of death after all operations performed within the last five years in all the hospitals of Lund in Sweden. There were in all 8,440 operations with 104 deaths. Of these 44 were due to pneumonia and 14 to pulmonary embolism. One fifth of all post-operative deaths due to causes which are generally attributed to the effects of inhalation anesthetic.

We believe and we teach that there is no better protection against pneumonia infection than the peritoneum itself. A certain percentage of our cases still die from sepsis and the man who could how accurately judge how far the anesthetic weakens this protective barrier would render us an immeasurable service.

The relation between anesthesia and post-operative mortality which though it may usually terminate in recovery yet entails physical suffering and often also economic hardship is even more elusive to the statistician but none the less real. Certainly the men who modified the ordinary ether narcosis or invented new methods must have been actuated by unfavorable experiences which rendered changes desirable and not by a desire "to die in pain upon which hanging their names."

All of these innovations however have found only a very limited following and from one end of the continent to the other the open ether method still reigns supreme. The more remarkable as the operator consciously or unconsciously is in everything

I have, however, shown that pulmonary complications may occur even after very brief ether anesthesia and that the mortality rate is not so low as is generally supposed. Read before the American Gynecological Society, Boston, May 20, 1914.

impulses do not reach the brain, spinal anesthesia is the ideal measure of anoci association. With most other anesthetics, the shock of a prolonged operation is reinforced by the progressive toxemia of the anesthetic. With spinal anesthesia the emergence of the nerve-roots from the anesthesia as the operation proceeds usually results in the patient leaving the operating table in a better condition than he was during the early stages of the operation [Babcock (13)].

It is quite true that analgesia is not perfect in all cases. Indeed to claim invariably good results would be to invite a justifiable skepticism and on the other hand an occasional failure in obtaining complete freedom from pain should not be sufficient to condemn the method. There are two possibilities either an attempt at spinal injection fails altogether or else the spinal injection having been made analgesia is more or less incomplete. Thus far I have been unable to perform spinal anesthesia in 47 cases. Twice the tumors were monstrously large so that the patient could not bend forward and there by separate the vertebrae sufficiently for the introduction of the needle. In three cases two of them complicated by obesity the needle entered the spinal canal but no fluid escaped indicating perhaps abnormal conditions within the arachnoidal sac which rendered the injection of the anesthetic inadvisable. In one instance the spinal fluid was mixed with blood and the injection therefore omitted. In such a case a part of the anesthetic would leak into the circulation and the remainder would *a priori* be insufficient to produce analgesia.

In about 150 cases where spinal injection was performed analgesia was insufficient on three occasions so that a general anesthetic was required throughout the operation. This was due to fault in technique which I hope to avoid in future. Repeatedly a few whiffs of ether had to be given either in the beginning because of great nervous excitement of the patient, or else at the end of long and severe operations. Not infrequently the inhalation of alcohol or some aromatic oil (oil of laender or orange) had a satisfactory though only suggestive effect.

Whatever the causes be, one simply has to count on a certain small percentage of failures. For this fact we have enough statistical material, from which I have selected a few of the more recent reports. Kronig in 2140 gynecologic operations chloroform or ether was added in 1127 cases counting even the smallest amount given. Sellheim in 1000 operations complete and undisturbed anesthesia was observed in 861 per cent and a total of disturbances in 139 per cent. Morrison in 1295 cases a general anesthetic was required on 36 occasions — throughout in 17 operations and during the latter stage in 19. Allen 320 cases with 19 partial or complete failures to produce anesthesia. Helm 1,419 cases with 105 failures making 74 per cent. Dax in 1500 cases there were 6 complete failures, 37 incomplete analgesias without addition of a general anesthetic, and 38 incomplete analgesias with the addition of a general anesthetic.

After all, the addition of a minimum amount of ether which is too small to injure the organism is not a serious disadvantage. In one of my cases a difficult abdominal panhysterectomy for large bilateral cysts with extensive adhesions the operation lasting almost one and one half hours, 100 drops of ether were used, and I consider this preferable to repeating the spinal injection as recommended by Richardson (14) and others.

The range of spinal anesthesia in our special field of work is unlimited. The accompanying tables of my operations will show at a glance that every kind of gynecologic operation can be done with its aid. As, in some instances multiple operations were performed on the same case the number of patients subjected to spinal anesthesia is slightly smaller. Minor operations such as curettages, trachelorrhaphies, amputations of the cervix, or hemorrhoidectomies which were done in conjunction with major procedures have been left out of consideration.

Of these cases four have died. These fatalities, which occurred about two years ago have already been reported in my paper (5) at the meeting of the American Medical Association in Minneapolis, June 1913 but

upon by Krönig (6) Sellheim (5) Morrison (7) Dax (4) Schuette (8) Helm (9) Allen (10) and many others. One must agree with Krönig when he demands that any reports of death due to spinal anesthesia must hereafter contain all details of the technique employed before they can be admitted to serious consideration. A case in point has recently been published by A. I. Rockey (11) but it cannot claim any weight in this question, as the report contains neither the amount and concentration of the anesthetic used nor the exact mode of injection.

The number of deaths from spinal anesthesia which have occurred in spite of all precautions is undoubtedly very small and must be charged with those unavoidable accidents which are due to our human limitation.

If the anesthetic is too thick or too full in less than the toxic dose collapse will be the result a complication which has steadily increased in frequency with growing experience. I have observed it but once in one of my earliest cases that of a stout and rather fat woman with nephritis and a flabby heart in whom a vaginal hysterectomy was to be performed. In this case a typical collapse occurred when the patient was brought too abruptly from the sitting into the dorsal position even before the operation had commenced. An injection of strychnine and the introduction of oxygen quickly revived her and the operation was successfully and painlessly carried out.

Minor complications such as air hunger and tendency to faint are probably due to the decided effect of spinal anesthesia upon lowering the blood pressure. They are readily combated by stimulation but usually subside without any treatment.

But if there is no longer any physical danger is not the psychical trauma a serious drawback? This objection is caused by a gross misconception of the actual conditions. The patient is not conscious in the sense in which the operator or the audience are conscious. It should be borne in mind that the patient's sensibilities are dulled when she enters the operating room. She has received bromides the day before the operation

and a dose of chloral at bedtime and she is under the influence of an injection of morphine-atropin or morphine-scopolamine when spinal anesthesia is about to be administered. In many of the German clinics she is brought to the table in twilight sleep. The intraspinal injection itself is no more painful than the hypodermic injection given half an hour previously and since the operative manipulations are not perceived, the preliminary administration of morphine can exert its soporific influence to its fullest extent. It is interesting to compare the apprehensive attitude of bystanders with the composed frame of mind on the part of the patient. The operator himself may at first be affected until the novelty of the experience has worn off. If nervousness is quite pardonable for we all are more or less creatures of habit and we have become used to seeing our patient in a state of unconsciousness. Personally I prefer to chat with my patient during the operation rather than bear her labored breathing, her deep snoring or the rattling of mucus in her throat, all of which remind me unpleasantly of the interference with unobstructed oxygenation of her blood.

Let us consider further advantages of spinal anesthesia during the operation. Some patients are nauseated and even vomit but almost without exception the emesis is very slight and rarely occurs more than once. The nature of the operation is not the cause for the vomiting may occur even before an incision is made. Allen and Donaldson (12) found that they could diminish nausea and emesis still further by giving a light breakfast before the operation.

The abdominal wall is more fully relaxed than with any other method of surgical anesthesia, and the intestines remain, in most cases, quietly within the peritoneal cavity. This facilitates the application of retractors and diminishes traumatism to the abdominal parietes. It obviates brusque handling of the uterus with its well known sequelae frequently eliminates the use of gauze packs, and generally renders operative manipulations easier. All this tends to lessen the operative shock and as nerve

anæsthetic Kronig has observed headaches in 897 out of 2074 cases, or 47 per cent. He remarks that the choice of the anæsthetic plays no part in the causation. The frequency and intensity of headaches seems to him to depend more on the social stratum and the age of the patient. Wage-earners women from the rural districts, and those beyond the age of fifty suffered less neuro-pathic individuals suffered severely from these headaches.

Morrison noticed headaches in 15 per cent of his cases, and found that persons prone to headaches on slight cause furnished the largest group. Schuette believes that patients suffering habitually with headaches should be excluded from spinal anæsthesia. He observed that coffee or brandy given immediately after operation seemed to exert a pre-entive effect.

Backache lasting one or two days was noted in ten of my cases. An ice bag applied to the site of injection usually relieved the symptom. No notes have been made of backache after a corresponding number of general anæsthesia.

In two instances the bedside notes recorded numbness in the legs and one patient complained of pain in the feet on the day following the operation. Usually however free mobility of the legs is regained within an hour or two after operation.

A partial paralysis of one leg which however gradually subsided was observed in one case in which the needle was not introduced in the median line and probably pierced one of the spinal nerves.

One patient who had had an abdominal palsy for many years for fibroids exceedingly well developed a slight psychic disturbance during the next 10 days but eventually recovered completely. Stemmer (6) quite recently mentioned a case of mental disturbance (amentia) after a gynecologic operation which terminated in puerperal convulsions and concluded therefrom that patient with an unstable psychic equilibrium had better be subjected to general anæsthesia.

Warning late complication which were now and then required in the earlier days of spinal anæsthesia seem to have become less

frequent and all authors agree nowadays that lasting ill effects are conspicuously absent. Among Helm's 1,419 cases there were 174 with late complications such as headaches extending over months, paræsthesias and neuralgias of the legs etc. but all were cured finally. He suggests that these were perhaps due to slight infections and recommends increased attention to asepsis.

That such complications, however, can not always be charged to spinal anæsthesia is proved by a case that came to my knowledge recently. A woman developed paralysis of both legs soon after myomectomy in spinal anæsthesia but when she was seen about two years later she exhibited the typical picture of tabes, and Wassermann reaction proved positive.

At times post-operative symptoms may give rise to grave fears and yet subside spontaneously. Such a case was reported by Vogel and Kraemer (17). A man of 75 years, suffering with asthma was subjected to herniotomy under spinal anæsthesia. After operation there ensued a complex of symptoms resembling heart block and consisting of bradycardia (36 beats a minute) dyspnoea, incontinence debility and tenesmus but all these symptoms disappeared gradually.

It seems to me that we have to deal here with an unusually pronounced effect of spinal anæsthesia upon the blood pressure. Babcock has paid particular attention to this phase of the problem and has observed that involvement of the upper dorsal nerve root causes a slowing of the pulse down to 40 or 30 while the blood pressure may sink to its lowest level. The involvement of only the lower spinal segment may produce merely a slight reduction of the pulse rate and blood pressure. The action on the circulation begins soon after the motor paralysis reaches its acme or in about fifteen or twenty minutes and gradually passes off.

That the strict observance of an improved technique would in all probability avert an involvement of higher segments, has already been mentioned but even when the injection has been done with all necessary precaution the effect on blood pressure may be quite marked as exemplified in the following chart.



pressed tendons muscles, and overlying soft tissues. The peripheral portion of the mass in contact with the eroded internal condyle, and with the shaft above, exhibits a discrete yellowish granular layer which to the feel, suggests disintegrating bone. The hollowed-out condyle is hemorrhagic in appearance, irregularly roughened and from its cavity there may be scraped here and there, softened osseous tissue. On sawing through the entire thickness of the condyle, the cut surface is seen to present a similarly softened and congested appearance. Posteriorly the femur is destroyed over a distance approximating 5 cm. through this aperture the mass has made its way into the popliteal space where it shows a smooth posterior contour in apposition to the fatty tissue. The sectioned surface of the hardened lesion presents a variegated appearance a large portion of it is dark red to red-dish black in color evidently due to altered blood. Elsewhere it is gray to a faint yellow. Occasionally small softened areas are seen the mass crumbles readily on handling. No evidence of bone structure can be detected in the mass other than that noted on its peripheral erosive surface. Detached fragments of tissue removed from the face of the lesion and hardened in preserving fluids have a peculiar staggy worm-eaten appearance.

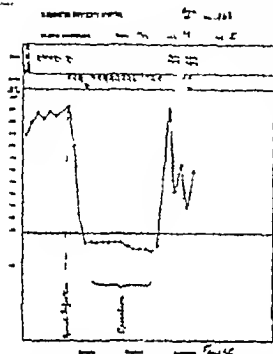
**Microscopic examination.** Blocks of tissue for microscopic study were taken from different portions of the main mass to show its variable histologic structure from the eroded bone at several points in contact with the lesion also from the synovial membrane and soft tissues below and external to the lesion.

The reddish black areas consist of hemorrhagic extravasations from thin-walled, engorged blood vessels together with dilated vascular spaces. There is also a good deal of fibrin in these areas. The lighter colored portions are made up essentially of young fibroblastic tissue the most striking feature of which is the large number of well-defined multinucleated giant cells (Fig. 14) varying in size from small cells with two or three nuclei to large structures containing as many as 100, or even more nuclei. The nuclei show mainly a central, or unipolar grouping and, in the larger cells, are surrounded by an abundance of deeply

staining cytoplasm, which is finely reticulated granular or vacuolated. The vacuoles are prominent (Figs. 14 and 15) many exceed the diameter of erythrocytes while others are very small. Frozen sections stained with Scharlach R show numerous fine fat droplets in the cytoplasm of the giant-cells, located for the most part within the smaller vacuoles. The large vacuoles contain particles of blood pigment, disintegrating red cells and the remnants of other tissue cells.

Giant-cells are not confined solely to the fibroblastic stroma, but are encountered in other parts they are quite common, for instance, in the midst of massive hemorrhagic areas and within dilated vascular spaces. Throughout the lesion no matter where found, the giant-cells have the same general characteristics, which are those of the foreign-body type of cell. They are undoubtedly derived from the fusion of endothelial leucocytes proliferated from vascular endothelium. This idea is supported by the presence of scattered mitotic figures in endothelial cells, and also by finding scattered groups of two or three cells not yet entirely coalesced to form typical giant-cells. It is quite evident from a close study of the histopathology of the lesion that the opportunities for foreign body giant-cell formation are excellent, and are due to a great extent to the large amount of hemorrhagic granulation tissue. Another factor which contributes to the attraction of endothelial leucocytes and formation of giant-cells is widespread necrosis affecting particularly the extravasated areas and zones in the immediate vicinity. Large and small droplets of fat, within endothelial cells and without, are seen in great numbers, not only in the necrotic areas but also in the better preserved portions of the lesion. This fat is derived from the extensive tissue necrosis. Moderate numbers of cells of the lymphocytic series, with occasional polynuclear leucocytes are found in and about the areas of necrosis.

Fibroblasts are numerous and are observed in all stages of development. Many of them produce narrow bundles of collagen fibrils, as may be demonstrated with Mallory's aniline blue connective stain. Fibroblastic proliferation is well advanced in the regions where



Morrison found a faint and transient albuminuria in a few patients whose urine was free from albumin before the peritonitis.

A more regular phenomenon which thus far seems to have escaped the attention of observers is the appearance of acetoneuria after spinal anesthesia. My findings will later be reported in detail. For the present it may suffice to say that out of twenty cases acetone occurred in the urine in all but one case. The acetoneuria disappeared spontaneously about 12 c.d. after operation and in no instance did it affect the general condition of the patient or interfere with the recovery.

The occurrence of all these more or less annoying after effects (enumerated above and even the possibility of more serious complications, must be clearly understood if a true picture of spinal anesthesia is to be developed. On the other hand the undesirable sequelae should not be unduly magnified so as to overshadow the truly remarkable possibilities of the new method. It has been shown in Tables I and II that all gynecologic operations can be performed under spinal anesthesia.

It remains to be said that in a large number of these cases the condition of the individual patient was such as to strongly contra-indicate the inhalation of ether unless the additional danger from the narcosis was to be superimposed upon the risk of the operation itself. My own 160 operations are so few that I would not venture to refer to them were it not that operators with an infinitely larger material have already shown us the brilliant achievement of spinal anesthesia in operative series of impressive size. Like many others, I have employed spinal anesthesia at first only in cases on which I was afraid to operate under ether—senile or debilitated diseases complicated by myocarditis, nephritis, exophthalmic goiter, advanced age etc. and only when spinal anesthesia stood this particularly severe test did I extend the application of the method without being in losing sight of the terrible danger of ether or nitrous oxide in suitable cases.

What, then, are the indications for or against the use of spinal anesthesia?

Doederlein and Krönig regard as the chief advantage of spinal anesthesia the fact that we have to deal in the main with a form of local anesthesia in which the greater part of the poison is deposited around the site of the infection and is thus rendered harmless, while in every inhalation narcosis the poison enters the circulation and produces undesirable toxic effects on the other organs, particularly the heart and lungs. Therefore post-operative cardiac disturbances and pneumonia occur far less frequently after spinal anesthesia than after inhalation narcosis.

It is, moreover, a matter not of theory but of actual experience that patients with pulmonary troubles or heart lesions bear a spinal anesthesia better than inhalation narcosis. The same is true of patients with kidney disease or diabetes, and it has further been proved that operations on aged people lose many of their dangers when performed in spinal anesthesia.

Bainbridge (18) sums up the question by saying: "The indications for spinal anesthesia are: 1. Cases in which the contra-indications for inhalation narcosis are present."

It has abundantly been proved that spinal anesthesia is less dangerous than ether and if its employment is not only justified but demanded in "bad cases" it is but logical to use it in cases which are not complicated by other organic or systemic disturbances.

As a matter of fact, Doederlein and Kronig, Allen, Babcock and most of the other operators with large personal experience draw just this conclusion. They prefer spinal anesthesia over inhalation narcosis in all operations with a high mortality such as operations for cancer and fibroid but since there is a certain degree of risk in any laparotomy they use spinal anesthesia in all abdominal operations in preference to inhalation narcosis.

That the storm and stress period of spinal anesthesia has passed and mere enthusiasm has given way to wise caution is shown by the list of contra indications in which most authors concur. This includes pronounced kyphoscoliosis and other marked anomalies of the spinal column and pressure points along the spinous processes which might indicate abnormal conditions within the arachnoidal sac, such as adhesions or lack of cerebrospinal fluid; furthermore, diseases of the central nervous system, profound shock or marked hypotension from other causes, sepsis, and fevers of unknown origin. Spinal anesthesia is also contra indicated in neuro-pathic individuals and where there is a strong prejudice against the method. Whether it is applicable in children is still a mooted question in which I have no personal experience. I can affirm from numerous observations that syphilis is not the contra indication it was formerly believed to be.

Suppurations and eruptions near the desired site of injection forbid the use of spinal anesthesia until aseptic conditions can be established.

I have endeavored to present to you the present status of spinal anesthesia in as objective a fashion as my own leaning toward the new method would permit, and to draw a picture in which light and shadow are evenly divided. Since Roentgen's discovery no greater no more stupendous ad-

vance in our therapeutic procedures has been made than this method of rendering the most extensive operations absolutely painless. For this we gynecologists above all others must feel particularly grateful to Corning, Bier, Tuffier and all those who with indefatigable zeal have improved the technique of spinal anesthesia until to-day it appears to be perfect in all its essentials. Spinal anesthesia has had to face skepticism and prejudice. The former must yield before the positive proofs which the advocates of spinal anesthesia can produce and prejudice will eventually wear itself out. If Donaldson complains that despite the gratifying results of his first year's work prejudice on the part of the public, both medical and lay, has interfered with his efforts, he may remember that less than eighty years ago the followers of Ephraim McDowell were publicly denounced as murderers and subjected to persecution.

But ovariectomy has survived prejudice and so will spinal anesthesia. A method by which many human lives may be saved can not disappear from our therapeutic treasury and it requires no prophetic gift to predict that from year to year it will become more appreciated and maintain its high place among the methods of surgical anesthesia.

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A STUDY OF THE END-RESULTS OF INTERPOSITION OF THE UTERUS<sup>1</sup>

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Of the many operations which have been suggested and performed for the cure of prolapse of the uterus, descent of the vaginal wall and the accompanying vesical hernia noneunkle that described by Halden in his thesis for entrance to this society in 1912 has given us such satisfactory results as those obtained from interposition or transposition of the uterus when the indication for the procedure have been properly selected.

The Watkins operation as described by Thomas J. Watkins of Chicago differs in many ways from the technique employed by Schauta, Wertheim and others, presenting a refinement of gynecological technique indigenous to American surgery. The surgeon exhibits a yet but a vague conception of plastic surgery, especially of pelvic plastic, neither does he take into consideration the weight or size of the uterus that he is about to interpose nor the type of prolapse he is dealing with. This perhaps explains the failures so often reported.

The normal support of the uterus may be enumerated as follows:

*First* the uterine ligaments, especially the uteropelvic and uterosacral which maintain the cervix in its normal position.

*Second* the pelvic floor and pelvic fascia which make up the pelvic diaphragm.

*Third* the supporting action of the adjacent pelvic organs.

*Fourth* the action of the intra-abdominal pressure.

And *finally* the axial relation of the uterus to the vagina.

The basic principle of maintaining the uterus in position is the retention of the cervix well back in the hollow of the sacrum while the fundus rests on the pubic shelf. This depends largely on the upward and backward traction of the uterosacral ligaments, the integrity of the fascial sheet and the upward supporting action of the pelvic floor.

The types of prolapse. Descent of the uterus is always attended by more or less intorsion of the vaginal wall and takes place along certain cleavage planes as, for instance, the uterus may slip through (1) postpubic attachments and allow the anterior segment of Hart including the bladder, urethra and anterior vaginal wall to prolapse through the vulva. Intorsion or the original injury may be through the (2) vesical plate of fascia, allowing a hernial protrusion of the bladder (cystocele) or may be due to a laceration through the (3) rectovaginal sheet and the levatores ani with consequent rectocele or rectal prolapse especially when the anal fascia has been included in the injury.

Enteroptosis and an increase in intra-abdominal pressure are factors that persist long after any operation is done for prolapse of the uterus and therefore are potent causes of relapse. It must not be lost sight of however that descent of uterus may occur in women who have never borne children or who have never sustained sexual relations. In proclitelia, the inverted vagina becomes thickened and rudimentary and the epithelia become dry and horny owing to the fact that the inverted vagina is the seat of a chronic venous stasis and is no longer maintained by the cervical secretion.

The continued erosion produces permanent tissue changes in the intravaginal portion of the cervix and the vaginal walls causing the cervix as a whole to be greatly elongated and thickened. The body is likewise enlarged, and the bladder is prolapsed and shows the morbid fringe of chronic catarrhal inflammation of the mucosa and of inflammation of the muscular coat.

In the operative procedure we should take into consideration a study of the type of prolapse to be dealt with for an operation which is applicable to one type may fail in another. Each case should be studied as to

the cleavage plane of its descent the size of the uterine body the amount of infra or supravaginal hypertrophy of the cervix the extent of the vaginal inversion the degree of the cystocele and rectocele including the edema and general condition of the vaginal walls, the presence or absence of adhesion, adnexal tumors etc. the degree of visceral ptosis and intra-abdominal pressure should also have consideration, and finally every patient with pelvic prolapse should be examined in the standing posture to appreciate the amount of descent.

Interposition or transposition of the uterus may be elected in women past or near the menopause where the uterine body is small or can be sufficiently reduced in size and is not diseased by degenerative changes and when the hypertrophy of the cervix, infravaginal and the cystocele is the chief complicating lesion, provided the prolapse has not occurred at the post-pubic (aka age) plane. This may be determined by the position of the urethra and a test of its attachment to the pubis.

*The technique employed.* In our clinic the procedure employed was:

*First* In a high amputation of the cervix except when the uterus is atrophic.

*Second* In a longitudinal incision through the anterior vaginal wall from just behind the meatus to the cervix each lateral flap is grasped by a ring forceps and the bladder stripped off from its attachment to the vaginal wall in the line of cleavage by blunt dissection.

The separation of the bladder from its anterior lateral and posterior attachments and control of all hemorrhage by clamp and ligature are the most important steps in this operation. The bladder is next retracted and separated from the anterior uterine wall and the front of the broad ligaments, when the vesico-uterine fold of peritoneum bulges into space between the uterus and bladder where it is incised and the blade of the retractor inserted into the peritoneal cavity holding the bladder upward and forward. This allows the operator to climb up the anterior face of the uterus with traction hook and antevert the uterus under the bladder. The adnexa are now thoroughly explored and given such

surgical attention as may be needed or if the woman is still of the child bearing age the tubes may be tied with fine silk and excised. With the fundus drawn well forward into forced anteverision, the anterior fold of peritoneum making the vesico-uterine pouch is sewn to the posterior surface of the uterus just above the internal os. This makes the uterus extraperitoneal.

Two chromic gut sutures are now passed from the lateral vaginal wall on one side just posterior to the meatus through the anterior wall of the uterus below the level of the round ligament insertion and out through the lateral vaginal wall on the opposite side. The ends of these two sutures are clamped drawn taut and held up by an assistant, while the fascial layer of the anterior vaginal wall is united by a continuous suture of iodized catgut.

The mucosa is finally closed with a series of interrupted sutures of chromic gut so as not to shorten the length of the anterior vaginal wall. Before the catgut sutures are tied, the mucosa posterior and to each side of the cervix at the vault of the vaginal fornix is denuded and a silver wire suture is passed through the area including the base of the broad ligament across the front of the uterus and out through the base of the broad ligament of the opposite side. This, when tied, lifts the cervix upward and backward in the manner suggested by Baldwin in his plication of the anterior vaginal wall. A high perineorrhaphy completes the operation.

*The causes of morbidity.* In our early experience there was a considerable morbidity following this operation which was largely due to our inexperience with the technique. One of the most troublesome causes of morbidity was the difficulty in securing perfect hemostasis resulting from the wide lateral separation of the bladder which extended into the venous plexuses just behind the pubic ramus. Hemorrhage at this point is extremely difficult to control, and, if not perfectly controlled, results in an intraligamentous hematoma which is very liable to become infected. Several of our cases developed a lateral parametritis, and in one the uterus was embedded in a post-operative blood clot exudate for many months.

*Injury to the bladder* The bladder is liable to be injured while separating it from the anterior uterine wall unless the uterine ligament is located and cut early in the dissection. If this is done it is possible to separate this vessel from the uterus and front of the broad ligaments without difficulty. It usually at this point heal readily when immediately sutured and the bladder is drained with a permanent catheter.

Vesical disturbances are not uncommon following interposition. These are partly due to displacement of the bladder and the relation of the uterine fundus to the vesical neck and are partly the result of catheterization necessitated by the vesical pain which is consequent upon the irritation of the perineal suture.

Colic still, trachelocystitis and trachelitis have produced a train of annoying symptoms.

The extreme anteversion of the body has occasionally produced an angulation of the uterine canal especially when amputation of the cervix has been omitted with resulting hematometra this angulation has occurred in two women just at the menopause in whom the uterus was atrophied and the cervix a senile type. Such a uterus normally retroverted and when the body is brought forward and fastened to the vaginal plate under the bladder neck the cervix has been amputated the sound shows anteversion not anteversion and adhesion of the endometrium are likely to occur at the point of flexion causing a retention of the normal secretion with dilatation of the uterine cavity. In our later cases we have met this by firming the base of the broad ligament in front of the short atrophic cervix thus bringing it upward in the pelvis which is a result in a straight anteverted uterus. Jyokuri has followed this operation with an immediate post-operative complication. The colon fistula has been the causative factor. Injury to the vesical circulation makes the bladder more susceptible to infection. Residual urine is retained and ascending infection takes place. Proper preliminary preparation of the patient has in our later cases prevented this lesion. Pre-operative tissue depletion for the reduction of edema by the employment of posture

douche and glyceride tamponades, etc. do much toward minimizing the venous oozing which takes place during the separation of the bladder.

Eighty-two cases individually studied make the basis of this report. All of these women were at or near the menopause at the time of operation except four who were in the active child bearing period and all of these four who were operated while still regularly menstruating were sterilized by ligation of the tubes with silk and section and suture of the uterine end of the tube. These four had had very difficult previous births, yet did not wish to be sterilized preferring to elect section in case of subsequent pregnancy than to go through future infrapubic deliveries. Two post-operatively deaths are recorded, one from acute uraemia the other from septic infection of an intrabdominal hematoma. In all the pelvic floor was restored by a high levator myorrhaphy.

The case shows a recurrence of the prolapse the fundus again fallen forward through the vulva into the introitus, owing to stretching of the anterior vaginal wall. These patients should never have been subjected to this operation, they were errors of judgment for the following reason. In one the uterus was too small and unable to act as a supporting bridge. In the other the fundus was too large and heavy to be held in position by the atrophied fascia of the vaginal plate. In the other two the vaginal inversion was too great to be properly remedied by this operation especially as the prolapse had originally occurred in the post-pubic cleavage plane hence the urethra and paraurethral structures, including the apex of the triangular ligament, afforded no pubic shelf on which the anteverted fundus could lie. All four of these women should have been subjected to a high hysterectomy. Sixty not only have an anatomical cure, but are free from all symptoms referable to the pelvis, nine others have anatomical cures, but are annoyed by pelvic symptom referable to the bladder, lower abdomen or vagina.

The large majority of these patients have been cystoscoped at some time subsequent to the operation and a constant cystoscopic picture has been revealed, i.e. there has been

some infolding of the bladder base the trigone being elevated and injected above the lateral portions of the base. Trigonitis has been present and producing some vesical irritation in nearly one-half of my cases. Instillation of twenty five-per-cent argyrol solution has given relief in nearly all. The vesical irritability has been intractable in only three, and in these we have produced temporary relief by the topical application of strong silver nitrate solutions to the ulcerative areas in the trigone.

Two in whom the anatomic and symptomatic result would be considered satisfactory have had intermittent attack of uterine distention from accumulated secretion behind an angulated cervix; these cases were referred to under possible complications.

Four are or have been pregnant. Of this number one miscarried at the third month without complication. One is now at the seventh month of pregnancy and presents the following anatomic relations. The cervix is high and well back in the hollow of the sacrum; the anterior uterine wall is still attached to the vagina but is not dragging it up, and is distinctly thickened, while the development of the gestation seems to be going on in the posterior wall and upper segment without symptomatic disturbance. The bladder seems to have adjusted itself to its new position. Unfortunately this woman will not be confined until after this report is a matter of record.

The third patient had a grave toxemia of pregnancy and was delivered spontaneously at six and one half months. This patient had a very stormy pregnancy for six months, suffering from constant pain in the lower abdomen, traction on the vagina, and marked dysuria almost from the beginning of her pregnancy.

One has passed through an uneventful pregnancy and was delivered spontaneously of a living child at term. The interesting feature of this labor was that the head was low in the vagina, actually resting on the pelvic floor from the onset of labor; the lower uterine segment was stretched out over the presenting part, and the internal os was effaced before actual labor pains began. Dilatation of the

external os and the vaginal introitus were almost simultaneous.

Dyspareunia has figured as a troublesome complaint among these patients. This has been especially annoying in the cases in which the entire length of the anterior uterine wall has been attached to the vaginal wall. One patient has had a persistent metrorrhagia for some months after the operation. A diagnostic curettage showed adenocarcinomatous degeneration of the body and this patient has recently been subjected to a hysterectomy.

Incidentally I would call attention to the case with which vaginal hysterectomy can be done after the uterus has been interposed. The operation is virtually an extraperitoneal procedure and the enucleation may be done practically without shock.

The causes of failure have been primarily —

*First* errors in judgment in the selection of cases for this procedure.

*Second* errors in technique.

*Third* atrophic tissue changes in the reconstructed supporting structures.

*Fourth* unrelieved intra abdominal pressure acting in conjunction with an abnormally large pelvis or in a pelvis of faulty inclination.

In the future causes one, two and four can be avoided but the actual supporting power of the reconstructed structures can never be estimated and tissue elasticity differs in different individuals; hence, a small proportion of cases will always relapse no matter how skilled the operator.

From this brief study admitting that the number of cases is too small from which to draw any general deductions, I wish to offer for your discussion the following conclusions.

*First* that interposition operations should be limited to women at or past the menopause with relatively small uteri and that when the procedure is elected in those still menstruating sterilization by tubal ligation should be done at the time of operation.

*Second* that cases of prolapse in which the sliding takes place in the post pubic cleavage plane are not corrected by this procedure.

*Third* that the morbidity is wholly due to technical defects i. e. improper preparation, imperfect hemostasis, fecal injury etc.

*Fourth* that in anteverting the uterus, the anterior wall of the uterus should rest on the fascial plate just behind the pubis, and the fundus should not be brought under the arch, as excessive anterior displacement not only

favors recurrence, but anteverts the uterus and interferes with drainage.

*Fifth* that the curettings from uteri about to be transposed should always be examined, as degeneration may occur.

## THE BEHAVIOR OF THE ABDOMINAL CUTANEOUS REFLEXES IN ACUTE CONDITIONS WITHIN THE ABDOMEN AND PELVIS<sup>1</sup>

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**I**N the clinical study of acute processes within the abdomen American surgeons have apparently paid but little attention to the abdominal cutaneous reflexes. The subject would seem to be worthy of study since these reflexes are affected constantly enough when certain local conditions exist to make them of some little aid to us.

The abdominal cutaneous reflex and its deportment in certain diseases of the nervous system is of course an everyday matter with neurologist; the test having a definite place in the diagnosis of certain nervous disorders. Without going into detail they find (quoted largely from Muller and Seidelmann) that these reflexes fail or are markedly diminished on the affected side of the body in spinal and cerebral hemiplegia of various origin and that this symptom persists even after the disappearance of the motor symptoms. They fail on both sides in multiple sclerosis and this is an early symptom of great value. They are usually exaggerated in early cases of tabes failing in late cases or in those that show an anesthesia of the skin of the abdomen. The reflexes are retained in patients with spastic paralysis until a late stage is reached and is a point of differential diagnosis between this disease and multiple sclerosis. In all nervous diseases in which there is increased abdominal tension they are diminished or lacking. Hysteria does not abolish them, even when anesthesia of the skin of the abdomen exists. They have been used also in the localization of spinal injuries.

Little literature exists however regarding

this reflex in connection with local conditions within the abdomen though European internists have interested themselves in the matter to some considerable extent. References to all publications that I could find have been placed in the bibliography and some of them are here briefly reviewed.

Rosenbach (according to Rolleston) in 1876 was the first to call attention to the importance of this reflex in clinical medicine and it has been frequently alluded to as Rosenbach's sign.

Bodon (in 1898) called attention to it in inflammatory conditions within the pelvis. He found as a rule that pelvic cellulitis does not affect the reflex while with pelvic peritonitis it was lost or diminished on the diseased side. He thought the primary nature and source of the inflammatory trouble might in some cases be thus distinguished or at least the diagnosis strengthened. His opinions were based upon a study of nearly 300 women.

Probably the first published studies of this reflex in acute abdominal diseases was by Jamn in 1904. He particularly emphasized the loss or impairment of the reflex on the right side of the abdomen in perityphlitis, and states that the test is here of particular value because we are dealing mostly with healthy young individuals with active reflexes. He noted also a disturbance of the reflex in "gall stone colic, cholecystitis and acute swelling of the liver."

Rolleston in 43 cases of undoubted typhoid fever found the reflex diminished or lost in 42. Of these the reflex was completely lost in 3

and impaired to a greater or less degree in eleven.

Sicaud, in 26 cases of typhoid fever in older children also found a marked diminution or absence of the abdominal reflex in 22. In two the involvement was transitory and in two the reflexes were not affected at all. He concludes that the abdominal cutaneous reflexes are affected at some time in the course of practically every case of typhoid fever the most frequent point of involvement being the right lower quadrant.

Muller and Seidelmann in a very comprehensive article on the abdominal cutaneous reflexes (one that is well worth reading) comment upon its behavior in acute surgical conditions within the abdomen. They say that one may regard it as a fundamental law that all diffuse or local diseased processes which take place within the abdomen and which cause a limited or general increase of tension of the abdominal musculature either weaken or prevent all or some of the abdominal cutaneous reflexes for the time that such increase of tension lasts. In distentions of the abdomen which take place slowly through chronic disease and are but little painful they are usually not disturbed for example those due to circulatory disturbances cancer or chronic tuberculosis. The same holds true with small ovarian tumors and in pregnancy that is not too far advanced. In oedema of the abdominal walls caused by heart or kidney affections and in intense lasting overdistention they are sometimes weakened though by no means always so. After evacuation by puncture of a large amount of ascites and the consequent relaxation of the walls, the reflexes previously present may sometimes temporarily disappear. In affections in which the distention takes place more rapidly the abdomen is painful, and rigidity is present, the reflexes are commonly lost, as with acute peritonitis or painful meteorism and frequently in typhoid fever. A one-sided and therefore significant disappearance of the cutaneous reflex is seen very commonly in localized acute inflammatory affections such as cause rigidity and circumscribed tenderness over the involved organ. They believe that under such circumstances

the loss of the reflex is always accompanied by rigidity and that the increased muscle tension simply covers or abolishes temporarily the normal response. They agree with Jarmin that the testing of the abdominal cutaneous reflex in the diagnosis of appendicitis has a certain value. They lay much emphasis on the technique employed in order to obtain reliable results.

The statements made in regard to the abdominal cutaneous reflexes have been in the main true. There has been however to my knowledge no series of observations published from which we might make a closer study of the question, and it was with the idea of doing this that I began two years ago to note the response of the reflexes in some of our abdominal cases. Since that time besides a considerable number of informal observations, I have recorded in 175 cases (mostly of acute diseases) the reflexes before operation and the condition met with at operation which followed soon after.

The abdominal cutaneous reflex may be obtained in practically all healthy individuals of both sexes with certain exceptions that must constantly be borne in mind. It is uncertain (it is said) in children under three years of age but is very active during childhood and adult life. As life advances it gradually becomes weaker or is lost, though exceptions even in individuals over sixty are plentiful. In those with obese abdominal walls it is common to see it weak or absent and the same is true of those whose walls for any reason are relaxed the most frequent cause being childbearing. Negative or weak responses in such individuals as constitute these exceptions, unless the difference in a certain section or in sections is very clear therefore means but little. Positive findings however have their usual value. I think this is a point to be especially emphasized.

A word as to the physiology. The centrifugal impulses pass through the posterior horns of the eighth to the twelfth dorsal nerves, thence along the posterior columns to the superior pyramidal decussation and through the middle lemniscus to the motor cortex of the opposite side, thence centrifugally along the pyramidal tracts to the cells in the an-

tenor horn of the last four dorsal segments. This arrangement, common to the other skin reflexes, explains its behavior in lesions affecting the higher centers. The reflex is apparently one of the body defences, its object being to protect the abdominal organs against injury by instantly making rigid the walls when threatened from without.

The testing of the reflexes is very simple, takes but a moment, and needs no apparatus — points of practical importance. Care is, however, necessary in order to obtain reliable results, a fact emphasized by various writers. The abdomen may be divided into quadrants, an upper and lower one on either side. Neurologists have sometimes made a division of six, three on either side, but four would seem more practical in testing for local conditions. I employ any kind of a dull instrument usually the blunt end of a pencil. If this fails, I sometimes use a pin drawn lightly over the skin. The stroke should be full, rather light and not too swift. It is applied in an oblique direction parallel with the line of the groin and the edge of the ribs. The first stroke is apt to give the strongest response, after that it usually weakens or is entirely lost, a point of importance when the reflexes are weak. One must be careful not to encroach upon territory supplied by another reflex. If the reflex is present, an almost simultaneous contraction of the oblique muscles or rectus (or both) takes place which when well marked will pull the umbilicus to the side that is being tested. When weak only a fleeting and slight depression of the wall is produced. One must see that the muscles are not willfully put on tension as it may weaken or destroy the response. Again if the stroke causes pain, a voluntary contraction is apt to take place on that side of the abdomen or body which, however distinctly follows the stroke but this will not deceive one if he is on his guard. Movements of the fat must not be confused with muscle contraction, an easy source of error in some cases.

As stated above the reflex is a very constant one in healthy young individuals, fully as much so as the tendon reflexes. Muller and Seidelmann, examining one thousand

healthy young soldiers, found the cutaneous reflexes always present with but one exception. They were all stripped and examined in the standing position, and were stroked with the blunt end of a pencil (rarely the point of the pencil was necessary). They found no great difference between the right and the left side under the same technique. The same obtained in two thousand healthy young women with normal abdominal walls and apparently intact abdominal organs, examined in the ambulatorium of their clinic. Even with fat or relaxed walls (for instance, after repeated childbearing) the reflexes seldom failed although they were often weakened and hard to obtain. It is well to bear in mind that they tested their subjects in a standing position. It is obviously impossible to test patients suffering from any of the diseases under discussion in this way. I have sometimes found in young healthy individuals the reflex weak or lacking in this or that quadrant without assignable cause; this is however exceptional.

The largest group in which we have made this test has naturally been that of appendicitis cases. We made note of the reflexes in 86 patients with this disease, eleven of these were chronic. In the eleven chronic cases here noted there was some involvement of the reflexes in five, three were women who had borne children, one was a man with very obese abdominal walls who had entirely negative reflexes and in one case (a woman) there was a negative reflex in the right lower quadrant, for reasons unknown. Except in the last instance then, these reflexes acted within their ordinary limitations. This does not represent the total number of cases operated during the same period, but I have found the reflex so little affected in our chronic cases that we made no further record of it.

There were 75 cases of acute appendicitis, with involvement of the reflex in 65. In ten the reflexes were not involved. The latter are instructive, three of them were boys, with rigidity and a well marked acute appendicitis. In children these reflexes are ordinarily very active, and we have learned to be cautious and not to place too much stress upon their presence in such individuals even with well

outspoken lesions. It is not improbable that in these cases there was a comparative diminution. One of these boys at least, left the hospital with exceedingly active reflexes, although they were but mildly present at the time of operation. In this group of exceptions were six men with a well marked appendicitis four with rigidity and two in which this latter symptom was not recorded. They all had active reflexes without the distinct differences to which alone we may attach importance under such circumstances and they must be regarded as exceptions.

In the other 65 acute cases, (56 under 40 years of age,) the reflexes were more or less involved. In 53 of them rigidity was recorded as also present. In seven the state of tension was not recorded, but we may assume that in some of these at least it was present. In five the reflexes were involved although there was no rigidity. The relationship of diminished or lost reflexes to rigidity is interesting. The two are so often present at the same time as to give rise to the opinion expressed by Muller and Seidelmann that physiologically the reflex is simply covered by the constant muscular tension present. Closer investigation, however does not always bear this out. We find that although rigidity may be almost universally present over the abdomen, the involvement of the reflex is frequently limited to the area over the lesions. Also with no rigidity that involved reflexes are not very uncommon under such circumstances.

The involvement consisted in a loss or occasionally a marked diminution, as compared with the others of the reflex of the right lower quadrant. Very frequently the involvement extended to some or even all of the others.

The extent to which the reflex is involved is significant. An involvement of the reflex of the right lower quadrant has almost always denoted a fairly well localized inflammatory process. With further involvement that is, an absence of the reflex of the upper right or lower left quadrant, the inflammation may yet be fairly well circumscribed. But when all are involved we have almost invariably found a considerable extension from the original

seat of trouble. In all severe extensions of the inflammatory process the condition commonly designated as general peritonitis, all the reflexes have invariably been absent. When other symptoms of appendicitis have been definite and we have found little involvement of the reflex, we have occasionally found the reason for the same on opening the abdomen. In such cases there has been slight or no involvement of the peritoneum. The appendicitis has been very mild or the appendix has been found to the outer side and underneath the cecum, or well down in the pelvis. The prognosis in any given case of appendicitis is affected principally by the pulse condition of the circulation and the local symptoms present. Among the latter the extent of the involvement of the reflexes is important and may with limitations be depended upon.

We have noted the reflex in six acute gall bladder cases. In these there were no stones present, but there was a more or less active state of inflammation. In five of the six rigidity was present and the reflex of the right upper quadrant was involved. In the chronic cases, with or without stones of which we have, however but formally noted five, we found no involvement that could not be accounted for by age or by flaccid or obese walls. In a number of cases of acute cholecystitis (unoperated) we commonly found the upper right quadrant involved although no record has been made of these, since they were not verified by operation.

We noted the reflexes in ten cases of pelvic inflammatory disease that were more or less acute in character and with pus present in all. None of these of course was acute in the sense that we speak of acute appendicitis but all were cases that were not subsiding satisfactorily and could not be called chronic. In one other case which had positive reflexes there was a subacute exacerbation of an old chronic condition, in which pus was found. In our more chronic cases, in which record was not always kept, there was none in which the reflexes were absent. The involvement in these pelvic cases was quite uniformly in the lower quadrant on both sides. In women who have not borne chil-

dren the disappearance of the reflex would have significance but it cannot be used I believe to distinguish a pelvic inflammation from an appendicitis. The group is too small to warrant further conclusions.

Our group of ectopic cases, 13 in number is too small for any very definite conclusions. Five of these women had borne children, and for this reason little stress could be placed upon the involved reflexes. In one with rigid and distended abdomen the reflexes were also mildly present and in all the remaining cases the reflexes were normal. I am under the impression from this meagre observation that an effusion of blood into the pelvis and lower abdomen seldom affects the reflexes or is less likely to do so than an inflammatory process.

We have had four cases of perforated gastric or duodenal ulcer (all men) with marked abdominal rigidity in which the reflexes were totally lost except in one case where they were very slightly present in the lower quadrant when seen three hours after the onset of symptoms. Seven hours later the absence of the reflexes was general.

We have had twelve cases of acute obstruction of the bowel, a group so small as not to warrant very definite conclusions. The reflexes were uninvolved in seven, in four no stress could be placed upon the loss or diminution because of age or relaxation. In one a boy of sixteen there was total loss of reflex, but this must be regarded as an exception. We may tentatively conclude from these few cases that obstruction of the bowel commonly does not affect the reflexes.

We have also had a large group of miscellaneous cases many of which were acute or subacute in character and in which we found that the reflex varied. We have been fairly safe in estimating when the reflexes were

present, with no abdominal rigidity that no very acute process invading the peritoneum was present. Collections of pus outside of the peritoneum were almost uniformly attended by normal reflexes.

Our observations have led us to the conclusion that the abdominal cutaneous reflex has a distinct though limited value in acute conditions within the abdomen and that, although perhaps not as valuable a sign as rigidity (or lack of it) when combined with other symptoms, it is of value in strengthening our diagnosis.

In younger people with intact abdominal walls, since these reflexes are so constantly present, their involvement has a particular significance. In older individuals, or those with obese or relaxed walls conditions, of course frequently met with, the presence of reflexes has a far greater significance than their absence and we have learned to place but little stress upon such absence in these patients. To be of value to the surgeon he must not only develop a uniform and careful technique, but must study the matter to some extent in order to make it of practical value in diagnosis. To place too much stress upon it would lead to frequent error as is the case with most of our diagnostic signs.

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## ERUPTIONS FOLLOWING OPERATION

By FRANKLIN B. McCARTY M. D. CHICAGO

CUTANEOUS eruptions localized or general, are frequently observed during the administration of ether.

Such eruptions are usually transient and disappear before consciousness returns. There occurs, however, a later and more persistent post-operative eruption in some cases, and this takes on a very definite character often simulating one of the exanthemata.

A series of one thousand consecutive operative cases at the Free Hospital for Women, Brookline, Massachusetts, was observed with this point in view. In every case ether was the anæsthetic employed; the ether was of standard manufacture and contained four per cent of ethyl alcohol and none of the ordinary impurities of ether—acetic acid, sulphuric acid, hydrogen peroxide or aldehyde.

The changes produced in the body by etherization may be briefly summarized. The blood shows a polycythemia or rarely an oligocythemia with increased specific gravity; these changes being most marked immediately after etherization.

The amount of hæmoglobin is unchanged or slightly reduced, varying with the amount of ether used and the duration of anæsthesia, and there is a temporary diminution in the supply of oxygen and retardation in the elimination of carbon dioxide.

Hammersten has shown that there is some tendency toward hæmolytic due to actual dissolution of lipoids in the investing membrane of the red cells, but spectroscopic examination of the urine shows no increase in urobilin.

Various statements have been made as to the effect on the leucocytes in operative cases with normal convalescence. Cabot found no change in leucocyte count which could be attributed to etherization, and in a series of 36 cases reported by Cabot, Blake and Hubbard, there was in 1 case a leucocytosis ranging from 19,000 to 27,000, this

increase being attributed by them to the type of operation rather than to the influence of ether.

White found an increase to 21,000 with a relative and absolute polynuclear leucocytosis after operation, the count being highest five hours after operation and gradually approaching normal, which is reached in about five days.

Blood pressure shows no change other than a slight and transitory decrease immediately after operation. Bovée found that the amount of urine secreted showed little change after the first hour, although some reduction was noted in patients operated in the Trendelenburg position, due partly to retention of urine in the renal pelvis and partly to arrest of function from the position.

The amount of urea excreted is decreased during the first twenty-four hours and increased during the following two days.

The production of albumin has been the subject of considerable discussion, but the opinion seems to prevail that albuminuria occurring in a patient without previous renal disturbance is unusual.

Eruptions occurring during etherization are mentioned in some of the textbooks on anæsthesia, but the post-operative eruption receives less notice. It is mentioned by some of the earlier writers and apparently was of more frequent occurrence then than now, due probably either to impurities in the ether or to more frequent occurrence of sepsis. Lawson Tait described an urticarial eruption which occurred after operation and seemed to be commonly associated with various degrees of wound sepsis, but which was also found after such procedures as paracentesis, opening of an abscess, ovariotomy, and other cases of abdominal section.

Atchinson in 1886 described a series of cases in which a similar condition occurred. Irobryn and Williams state that "ether rash may occur in any patient, more often in women and children. It appears, as a rule, just as the patient

fibrin is abundant. Throughout the lesion however the fibroblastic tissue is young and has not yet reached the stage of marked collagen formation with fibrosis, contraction, and cyst formation observed in chronic fibrocytic osteomyelitis.

Section from the bone in contact with the mass may show the following pathologic changes (Figs 16 and 17): (1) engorgement of the blood vessels in the medullary spaces with perivascular hemorrhages; (2) many endothelial leucocytes phagocytic for blood pigment; (3) infiltration of the medullary fat tissue with lymphocytes eosinophiles and polymorphous leucocytes; (4) fibroblastic proliferation; (5) erosion of cortical bone and disintegration of bone trabeculae by giant cell osteoclasts. These latter are numerous where the resorption of bone is the most active.

Sections from the soft tissues limiting the mass externally show a reactive fibrosis which gradually passes over into a vascular granulation tissue containing foreign body giant cells (Fig 18).

Nuclear mitoses are not numerous, and are confined mostly to proliferating endothelial leucocytes.

#### REMARKS

From the standpoint of gross and macroscopic pathology the lesion, in its entirety, indicates a reaction to some injury—an inflammatory process of low grade chronic type. The injury inflicted might well be of a mechanical nature.

The histologic criteria employed in arriving at this conclusion and in differentiating lesions of this type from true tumor formations can be summarized briefly as follows:

- (1) The heterogeneous cellular picture—fibroblasts, endothelial and polymorphous leucocytes, lymphocytes, and eosinophiles.
- (2) Tendency to the formation of hemorrhagic granulation tissue.
- (3) The associated fibroblastic proliferation (regenerative).
- (4) The absence of definite evidences of rapid autonomous cell growth as indicated by the scarcity of mitotic figures.
- (5) The large number and character of giant-cells present (foreign body type).

Inasmuch as the presence of giant cells in medullary bone lesions of the type under discussion has been an important and prominent factor in diagnosis. It would seem advisable to determine what clinicopathologic significance can be attached to the finding of giant cells in such lesions. The question of giant cell formation has been much debated by pathologists during recent years, and there still exists some difference of opinion as to their general classification and meaning. However certain points have been brought to light which materially assist us in the interpretation of giant-cell reactions.

It is not necessary to enter into a discussion of this phase of the problem except to mention that for pathologic diagnostic purposes, it is desirable to divide giant-cells into two types: (a) so-called foreign body giant cells and (b) true tumor giant-cells. The first type has already been discussed. It is by far the commonest form of giant-cell. The second type is formed by rapid nuclear division resulting in multiple mitoses and multinucleated nuclei, without complete division of the cell body. This type of giant cell indicates rapidity of growth and is found in a variety of malignant tumors.

The distinction between these two forms of giant-cells is not always easy. It may be complicated by such factors as poorly preserved tissue, thick section or indifferent staining.

The giant cells in sections from Case 7 are so uniformly of the foreign body type as to make their presence very significant and the interpretation of the lesion much simpler. The complete absence of true tumor giant cells goes a long way toward explaining why it is that a lesion of this kind runs a comparatively benign clinical course.

Mallory contends that the term giant cell sarcoma should be given up as being incorrect and confusing; there is much to support this contention in examining these lesions.

We are of the opinion that an intensive pathologic study (with an idea of giant cell differentiation) of tissue afforded by bone conditions similar to the ones noted might serve to simplify and systematize our knowledge.

The scarlet fever eruption appearing a day or two later would be called a surgical scarlet fever.

In a series of one thousand consecutive operative cases at the Free Hospital for Women, in all of which ether was the anesthetic used there were 43 eruptions. This does not include the transient eruptions seen during etherization and in every case there was a definite interval of hours or days between the operation and the onset of the eruption. In 41 of the cases there was no other complication than the eruption the other two cases showing mild wound sepsis.

In no case were there any prodromal symptoms, and the eruption appeared suddenly some time after operation and was accompanied from the first by marked itching. It varied in character some cases showing a general pink erythema some a fine papular eruption which blanched on pressure and the more marked cases definite well marked papules, small to the size of a pea, discrete or crowded together and in places coalescent forming larger dark irregular patches especially over the bony prominences. The cases could be divided into two classes those appearing within twenty four to forty-eight hours of operation and those with a later onset, the latter following a more definite course. The cases with an early onset appeared as an eruption on the upper half of the body beginning either on face, chest, or arms and rapidly involving the abdomen and legs. The face was involved in almost every instance and the eruption varied from an erythema of brief duration to a papular eruption lasting several days, itching being quite marked, especially at first. There was no systemic disturbance and the temperature was elevated but less so than in the cases with later onset.

CASE Mrs. C. age 7, housewife, no history of previous eruption. Operation April 24, 9:30 repair complete laceration of perineum ether anesthesia. April 5 Fine discrete papular eruption appeared on arms and chest and spread rapidly all over the body including the face marked itching. Temperature (morning) 99° F (evening) 100° F leucocyte count 10,000. Eruption increased for next twenty-four hours and then began to subside. Temperature remained elevated at

100° F until April 30, when eruption had faded no desquamation. May Skin clear temperature 98.6° F leucocyte count 8,000.

Patient received no emetics or cathartics for nine days after operation.

The second class of cases had a sudden onset three or more days after operation, without prodromata but with a temperature which had continued higher than would be expected after operation. The condition varied in severity from those in which only a part of the body was affected to those in which the eruption was almost continuous over the entire surface. The condition began as an erythematous or fine papular eruption located at first on the inner surfaces of forearms and thighs, and extending over the entire body rarely affecting the face and never involving the palms or soles. It was accompanied by some itching which increased as the lesions extended and persisted until fading occurred. The papules were at first pink and later dark red and the eruption reached its height in twenty-four to thirty-six hours, after which it began to subside and itching became much less marked. The onset occurred as late as seven days after operation, and the condition lasted from one to seven days, the average being about four days, although some traces of the fading lesions appeared for two or three days more in many cases. It was noted that those cases in which the onset was delayed longest were of briefest duration and those cases which began on the third or fourth day after operation were of longest duration and greatest severity. Desquamation was not observed in any case.

CASE Miss B. age 34. Operation, May 25 9:30 dilat. and curettage appendicitomy. tenor fixation of round ligament. May 4 Temperature has varied from 100° to 100.6° F in evening since operation leucocyte count, 10,000 wound clean, no distention. May 5 Papular eruption on inner sides of arms some itching. Temperature 99.6 leucocyte count 10,000. May 26 Eruption all over body less marked on face than elsewhere. Papules coalescent, forming dark red patches over knees, elbows, and sacrum. No symptoms except itching. May 7 Eruption began to fade arms and face clear, still marked on back and body itching intense. Temperature 99.6 leucocyte count 9,000. May 30 Eruption fading rapidly itching.

is becoming comatose and takes the form of an erythema which occurs most frequently on the neck and shoulders but may spread to the chest and abdomen and even to the thighs. It is accompanied with profuse sweating and generally lasts less than ten minutes. When seen for the first time it suggests to the uninitiated measles or scarlet fever. Burnett states that this rash is probably no significance beyond showing the action of ether upon the sympathetic system.

Gottlieb describes an erythema simplex a condition of urticaria after operation in which are found paler, pale, dilated papules generally over the limbs and not accompanied by any rise in temperature. Stueben mentions surgical operation particularly those in the abdominal cavity as a rare cause of urticaria, probably due to the anæsthetic as found between distal nerves. It is described by several writers on kind cases as an illness known as erythema exanthematicum first described by Harlow which occurs after operation after injury and after the use of certain drugs as mercury and iodine. The lesions vary from a localized eruption to a general or almost continuous one and form an intermittent or constant constitutional disturbance to that of a severe fever with high temperature. The eruption is usually scarlatinous occasionally morbilliform and the color varies from bright pink or red to a sluggish red. It is ushered in with the ordinary symptoms of mild febrile disease with the development of skin rashes at the same time several hours later the constitutional symptoms commonly following with the appearance of the eruption. The eruption begins at the end of four days and is almost always followed by some febrile reaction, in some cases it is perceptible the whole course of the process occupying one to four weeks. Hoffmann in his monograph divided eruption following operation into four classes.

*First* Purely vasomotor disturbance due to irritation of sensory nerves, and occasionally after operation upon parts abundantly supplied with nerve. The sort of eruption appears a few hours after operation as an erythema or urticaria and disappears very

rapidly. Cases of puerperal scarlet fever are included in this class.

*Second* Toxic erythema due to absorption of septic and aseptic material from the wound or to the absorption of carbolic acid solution or corrosive sublimate or to the effect of ether. Such cases are analogous to the medicinal eruptions and appear without prodromal symptoms about twenty-four to forty-eight hours after operation. They occur even with simple fracture and Litchfield reports a similar condition found in animal which have been recently transfused.

The eruption appears as a diffused redness as isolated large patches with comparatively clear intervals involving only the body and extremities and disappearing in twenty-four hours without any subsequent desquamation.

The eruption usually marked febrile reaction, and in children delirium or coma may occur gastric symptoms often being very prominent. This form is supposed to be due to absorption of secretion of the wound or of particles of tissue or foreign material, such as occur in aseptic fever although in the same class is included the erythema due to ether alone in which no such absorption could occur.

*Third* Infectious eruption due to rapidity entails formed of clumps of micrococci and found in general infection as septicaemia and pyæmia. The eruption is more marked than in the toxic variety usually takes the form of an urticaria or erythema and may become pustular or hemorrhagic. It may be isolated or diffuse and may closely simulate scarlatina, being followed in many cases by more or less desquamation.

*Fourth* True scarlet fever—a communicable condition believed by some to be a mere coincidence and by others to be due to increased susceptibility due to the shock accompanying a wound, burn, or operation. This is especially frequent in children in whom brief the eruption is atypical and is followed by desquamation. McCollum holds that the condition is merely a coincidence stating that in a patient who has had recurrent attacks of appendicitis the presence of an undetected scarlet fever in its incubation stage may stir up acute appendiceal symptoms and cause the surgeon to decide to operate.

subcutaneously before etherization as a routine. Post-operative cathartics consisted in most cases of calomel gr. T ss in divided doses the night of operation, followed in the morning by magnesium sulphate ss. Pil rhei comp. were used as required after the second day. Some cases received only Sedlitz powder after operation, and one case received no cathartics or enemata for nine days.

Opel has reported cases of general eruption occurring in definite relationship to menstruation. Such an eruption has been designated as erythema pudoris, and has been noted during pregnancy and at the catamenia. Fox believes it to be due to subacute ovarian or uterine irritation acting on a naturally sensitive nervous system. Frank quotes a case in which removal of a chronically inflamed left tube and ovary resulted in cure. Of the cases observed five had passed the menopause, one had never had any catamenia, seven were in the premenstrual stage, seven in the interval, five in the post-menstrual, and one was menstruating at the time of operation, so that in these cases there was no relation between eruption and menstrual epoch.

Eruptions similar to those observed have been ascribed to many causes by different writers: calomel, magnesium sulphate, morphine, atropine, turpentine, resin, nitrous oxide, chloroform, ether, enemata, and meteorological influences. All having been considered the cause at one time or another. Eruptions due to mercury either internally by calomel or externally by bichloride are erythematous or punctate, general in distribution, with mild or severe constitutional symptoms, nausea and vomiting, and commonly show lesions of the buccal mucosa.

Morphine shows an erythematous or scarlatiniform eruption with intense itching, tendency to nausea, and contracted pupils.

Atropine may produce even in very small doses a scarlatiniform or patchy erythematous eruption appearing within twenty-four hours and accompanied by intense itching. The peculiar blushing of the face, dryness of mouth, and dilated pupils suffice to differentiate it.

All of the eruptions due to drug appear

within a few hours or a day of administration, whereas many of the eruptions after operation are delayed in onset for three or more days.

Climatic conditions have been claimed to have a large influence and disturbance of circulation, due to exposure to cold, east wind and changeable temperature have been held responsible for the condition. The occurrence of several cases within a day or two with considerable intervals was quite marked in this series, but barometric readings and amount of precipitation seemed to show no constant feature that might be associated with the condition.

Enemata as an etiological factor have been mentioned by Crawford Still, and Shepherd, the former not accounting for its occurrence other than to assume that the eruption is due to the absorption of morbid products following the use of enemata—as after the use of enemata following the operation for appendicitis. Shepherd found in his cases that eruption occurred most often in patients who had been given enemata of soap and water in the preparation of which common yellow soap had been used. When Castile soap was substituted for yellow soap the percentage of eruptions diminished considerably and he concluded that the effect was produced by resin contained in the yellow soap. He cites one case in which eruption followed the use of the yellow soap enema repeatedly and in whom no eruption occurred after the use of Castile soap enema but on again using yellow soap the eruption promptly appeared. He was at first inclined to attribute the condition to turpentine used in the enemata, but omission of turpentine caused no diminution in the frequency with which the eruption appeared. Two kinds of eruption were observed in his cases: a very itchy scarlatiniform eruption followed by desquamation, and a general papular eruption appearing later. In one case observed at the Boston City Hospital in which a general papular eruption followed immediately after enema in a post-operative case, the condition seemed to be due to irritation of the enema rather than to any ingredient, as a fresh eruption followed each enema regardless of

The temperature remained elevated before eruption appeared and until fading began, and in some cases this rise in temperature was quite marked while in others there was no change from the normal. The average increase was about one-half degree above that of an uncomplicated convalescence. The average temperature of a series of forty cases with an uncomplicated convalescence was compared with that of a series of forty cases in which an eruption but no other surgical complication had occurred, and it was found that the temperature in the uncomplicated cases became normal on the morning of the second day and did not exceed 99° F in the evening after the third day. In the cases with eruption there was an elevation of evening temperature above 99° F until the eighth day, that time corresponding to the disappearance of the eruption. The pulse was affected but little, remaining proportionate to the temperature and rarely rising above ninety.

The leucocyte count was taken daily after the appearance of the eruption, in sixteen cases. Leucocyte count was also taken in sixteen cases on whom similar operations were performed and who had uncomplicated convalescence, these counts being made before operation and repeated after operation until they coincided with that taken previously. In the uncomplicated cases the count reached normal on the fourth day after operation and in the cases with eruption the same proportion of cases without leucocytosis as was reported by Cabot. In the cases with eruption the average count on the fourth and fifth days, the time corresponding to the height of eruption, was 14,000 or nearly double that of the uncomplicated cases at the same time. After the fifth day the count fell rapidly to normal. Smear showed the increase to be polynuclear and there was no change in red cell.

Urinalysis was made in every case before and after operation and no albuminuria or aceturia was found, nor were casts detected in any case which had not shown casts previously.

The patients ranged in age from twenty

two to sixty years, and the operations in all but three instances involved the pelvic organs. The severity of operation or duration of anesthesia apparently had no bearing on the production of eruption, for the operations included simple curettage, appendectomy, plastic, hysterectomy and ventral hernia. The amount of ether required to maintain anesthesia varied, some requiring but little and others a relatively large amount. Nearly all were operated in the Trendelenburg position.

Two patients gave a history of previous eruptions, one following operation for proidentia and the other following parturition. Eight cases had been operated upon elsewhere and none had any recollection of any eruption. One had been operated upon at the Free Hospital for Women and had no eruption, the previous operation being a dilatation and curettage and the second operation a laparotomy. Five cases were operated subsequently at the Free Hospital for Women and none developed any eruption, although preparation and post-operative treatment were the same and in two instances the second operations were longer and more extensive. One patient had been operated previously for exophthalmic goiter, the exophthalmos persisting slightly and one was of a highly nervous type and flushed easily. In both cases eruption appeared within twenty-four hours.

Two cases showed surgical complications:—one a small subcutaneous hematoma in the abdominal wound which discharged after several days, and the other a mildly septic abdominal wound which later discharged a linen suture from the fascia. Four cases were drained for anticipated serum exudation due to large raw surface, three of these were large entral hernie and the fourth was a complete hysterectomy with spinal drainage. Aside from these the wounds united by primary intention, and convalescence was uneventful in every respect save for the eruption.

Preliminary preparation for operation varied somewhat as regards catharsis. Castor oil, calomel and magnesium sulphate were employed, and all cases received cleansing enemas containing turpentine the night before operation. Atropine gr. 1/90 was given

4. The eruption often simulates scarlatina, measles, and the so-called drug exanthems

5. The exciting cause varies drugs, emetata, anesthetics, and operative shock are included

6. The underlying cause is a vasomotor disturbance due probably to irritation of the sympathetic nervous system

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## CAN SURGERY BE ELIMINATED IN THE TREATMENT OF FIBROID TUMORS OF THE UTERUS?

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IF the query propounded in the title of this contribution were put to a vote of this society I believe that the verdict would be that the paper could be completed in one word—No. Unfortunately there is developing in the profession at large a more or less general belief that all fibroid tumors of the uterus can be cured with less danger to the patient, by roentgenotherapy than by surgical procedures. On account of this growing opinion I deem it not amiss to bring the subject before this society in the hope that the seal of its authoritative approval will be placed upon surgery as the proper treatment of these tumors unless for certain definite reasons, such treatment is contra-indicated in a given case.

That roentgenotherapy has a place and a very important one in the treatment of myomata is not to be denied. But I hope to prove that there is no justification for the view that surgery should be entirely supplanted

may be stated in passing that this opinion is not held by leaders of American surgery and roentgenology. In the preparation of this paper letters embodying a series of questions were sent to one hundred of our best known surgeons and gynecologists and to a like number of the members of the American Roentgen Ray Society. Replies were received from forty-four surgeons and gynecologists and in reply to the question, "Do you believe that all cases of fibroid tumor of the uterus (not including the submucous) should be treated by the X rays?" all answered in the negative. The same question was propounded to the roentgenologists and out of sixty-two answers received, nine answered in the affirmative, twenty-five in the negative and twenty-eight on account of lack of experience with the method, expressed no opinion. Of the nine who answered yes, three were in favor of

composition, both milk- and molasses and soap-suds and glycerine enemata having been used.

The etiology of these eruptions after operation is very obscure and various factors probably contribute to their production. There is found in every case some particular immediate cause and this may vary from the shock of operation to the mechanical irritation incident to the use of enemata. In addition to this there is the factor of individual idiosyncrasy which so affect the individual that conditions which ordinarily produce no change become noxious and cause pathological change. And finally there is the factor of nervous susceptibility that this is a considerable factor is evidenced by the fact that nearly five per cent of all cases operated in a gynecological service showed a definite eruption, a much larger percentage probably than would be found in a general surgical service. This is due in all probability to the fact that in most cases operation involved the pelvic organs, which are abundantly supplied with nerve fibers from the sympathetic system. In accord with this idea is a case which has been reported in which the pushing of a uterine sound caused eruption and a recurrence of the eruption appeared after each of fifteen similar procedures on the same patient. It has long been recognized that there is some association between the pelvic organs and the peripheral vasomotor system, probably through the sympathetic system and vasomotor erythemas, simple rosacea and acne rosacea are found five times as commonly in women as in men. One patient in this series gave a history of eruption following delivery five years previous. The delivery was entirely normal and no ether was given, nor were enemata used. On the day before operation a general papular eruption appeared and persisted all day having nearly disappeared the next morning. No enemata had been given up to the time the eruption appeared. Four days after operation a severe papular eruption with intense itching appeared and persisted four days.

There is no doubt that ether alone furnishes the stimulus which produces some of the eruptions, particularly those appearing very soon, but it cannot be regarded as the sole

cause for in some reported cases nitrous oxide or chloroform were used as anesthetics instead of ether. Absorption of wound secretion has been considered a frequent cause, and the presence of a slight leucocytosis and increased temperature might be attributed to undiscovered sepsis or to absorption of secretions such as is found in aseptic fever. Schustler and Ewald maintain that this latter condition is due not to fibrin ferment or to nervous shock, as is usually asserted, but to the presence in the blood of nucleins and albumoses which are set free by the traumatism. If absorption were the cause one would expect the eruption to follow all types of operation with equal frequency and would expect to find some elevation of temperature and leucocytosis in every case. Some of the cases showed no change in either temperature or blood count. It also fails to explain the eruptions after enemata and after simple etherization.

In general, it seems likely that the most important factor is the nervous shock produced by operation acting as a stimulus to the sympathetic system and so producing vasomotor disturbance. The cases where eruption follows simple enemata, etherization, or minor surgical procedures are due to this same factor acting upon an individual whose nervous system is peculiarly susceptible to such influences.

#### CONCLUSIONS

1. Eruptions following operation are of comparatively frequent occurrence particularly after operations upon parts abundantly supplied with sympathetic nerve fibers, as the pelvic organs, where they occurred in four and one half per cent of a series of 1,000 cases.

2. These eruptions occur after any of the common anesthetics—ether, chloroform, or nitrous oxide.

3. The condition is characterized by an interval between operation and onset of eruption, by lack of prodromata or of constitutional symptoms, by the presence of an erythematous or papular eruption with severe itching, and by the presence of an elevated temperature and moderate leucocytosis.

only burning but the stimulation of the growth of the fibroid and the increasing of malignant degeneration if it happened to be present. I am reliably informed that there are in use in the United States 20,000 X-ray machines, and that there are comparatively few competent operators. We have never been able to control the surgical treatment of disease. Men are operating all over the breadth of this land without adequate surgical skill or equipment. There is no reason to believe that roentgenologists will be able to control the situation any better than the surgeons. Wait until it becomes generally known to every man with an X-ray machine in his office that fibroids have been cured by roentgenotherapy, then see the mortality jump. If tumors are to be treated by the rays, then the treatment should be undertaken only by men who are competent to do the work.

The view that burning is the only danger of the treatment is not universally accepted, however, by roentgenologists. The Archives of Roentgen Ray, June 1913, speaks editorially as follows: "So far there has been little or no recurrence, but of course a considerable period must elapse before we are in a position to judge definitely of the value of the treatment and the safety of such enormous doses. When we consider the important tissues—intestines, peritoneum, blood vessels and glands—which must also be subjected to intense radiation, we realize how necessary it is to proceed with a good deal of caution. Henry Bedere drew attention to the possible injury to the intestines during irradiation of the pelvis and especially to the glands of Peyer. Haeussch says it is doubtful if every female woman should be treated, bleeding may be increased—two fatal cases have been recorded."

Danger may also result from treating unsuitable cases. Bordier (4) gives the following contra-indications: "When the fibroid is calcified, or presenting necrobiotic changes, those which are malignant, infected or gangrenous, or in the presence of such complications as pyosalpinx or pelvic peritonitis."

In order to broaden the opinion of American roentgenologists as to these contra-indications, the following question was presented: "What

would be the probable result of X-ray therapy on (a) malignant degeneration (b) cystic degeneration (c) necrosis (d) infection (of the tumor)?" There was no unanimity of opinion expressed, but it struck me as rather remarkable that 17 of the answers stated that the rays would benefit all of these complications. Practically all of the answers stated that the effect on malignancy would be retardation or possibly cure, though several emphasized the stimulation of the process if the treatment was improperly done. A few answers indicated that cystic degeneration would result in calcification, though the majority stated that the process would be increased. It was conceded by the majority that necrosis and infection would be made worse by the treatment and that these complications were a positive contra-indication to the treatment.

In connection with this phase of the subject the surgeons were asked, "In what percentage of your cases are you able to diagnose before operation, (a) malignant degeneration (b) cystic degeneration (c) necrosis (d) infection?" The roentgenologists were asked,

"Do you believe it advisable to have a gynecologist examine all cases of fibroids before beginning the X-ray therapy?" These two questions were asked for definite reasons. In the majority of papers on this subject presented by roentgenologists, the opinion has been expressed that a gynecologist should examine all cases before the beginning of treatment so that these various complications could be eliminated. My purpose in asking the surgeons the question I did was to show what I have personally experienced, that it is only possible to make a full and correct diagnosis in the majority of cases at the time of operation, and hence that such an examination under ordinary circumstances is without much value. I was not disappointed in the replies I received from the surgeons. Practically all agreed that a correct diagnosis is usually impossible before operation.

With but few exceptions the roentgenologists answered yes to the question, the principal reason given being that unless a competent person examined the patient unsuitable cases would be accepted for treatment. A few

voluminous literature of this subject gives no justification for the view that the X ray is preferable to surgery in the treatment of all cases of uterine fibroids. Inferentially however many of the papers published do express this opinion and as a result this view is being generally accepted as true.

In the beginning it may be well to discuss the relative value of the two methods as to cure. A cure I take it means not only the relief of symptoms, but the complete removal of the tumor. The results of roentgenotherapy have been reported by Mohr who gives an analysis of 796 cases so treated with known results in 669. Of these he reports as cured 376 or 56.2 per cent improved, 208 or 31.1 per cent unimproved, 74 or 11.1 per cent relapsed, 7 or 1.0 per cent dead, 2 or 0.29 per cent. Of 380 cases studied from the stand point of reduction in size 81 or 21.3 per cent were unchanged, 219 or 57.6 per cent showed a slight decrease, 52 or 13.7 per cent were considerably reduced, 20 or 5.3 per cent entirely disappeared in 3 or 0.8 per cent there were subjective sensation that the abdomen had become smaller in 5 or 1.3 per cent the tumor increased in size. If we study this report, we will note that while the claim is made that 56.2 per cent of the tumors were cured with a mortality of but 0.29 per cent in reality but 10 or 2.5 per cent were completely cured.

What can surgery show as to cure? I believe it must be admitted that except in those cases which die as the result of the operation or are not cured on account of recurring malignant disease hysterectomy cures all cases permanently. Hysterectomy however is not without its dangers. Hysterectomy for uterine fibroids has a definite mortality which varies it is true with the skill of the individual operator as to his technique and selection of his cases. One of the questions asked the surgeons was "What do you consider an average mortality in the surgical treatment (hysterectomy) of fibroid tumors of the uterus?" The answers indicated an average of 2.5 per cent. A study of the reports of twenty-one Philadelphia hospitals for one year showed records of 494 cases treated by hysterectomy with 17 deaths, a mortality of 3.8 per cent.

This, I take it is a fair average mortality though practically all the papers on the value of roentgenotherapy place the surgical mortality at 5 per cent.

The following question was also asked the surgeons. "In what percentage of your cases have you found malignant degeneration?" The replies varied from 1 to 10 per cent, and the combined figures would indicate an average of about 5 per cent. The roentgenologists quoting from previously reported papers by Noble, McDonald, and others, place the frequency at 2 per cent.

Now if we accept the high primary mortality of 5 per cent and the low percentage of 2 for malignant degeneration, and admit, for the sake of argument, that no case of malignant degeneration is cured by surgery we have as the result of hysterectomy 93 per cent of absolute cures as against 5.3 per cent for roentgenotherapy. This conclusion may be criticised on the ground that we should accept a cure by roentgenotherapy the first published figures of 56.2 per cent. Even admitting these figures, there is no comparison as to the value of the two methods. What might have we however to assume that the 93.7 per cent of the tumors which were not removed will not at some future time take on such anoo degenerations and complications as will ultimately destroy the host. The trouble has been that only the relative immediate mortality of the two methods has been compared and not the ultimate result.

It must be admitted that the immediate mortality of hysterectomy is higher than that of roentgenotherapy. In spite of this, however we must take this extra hazard as we are not justified at the present time in regarding a certainty for an uncertainty.

Is the use of the X ray treatment without danger? One of the questions asked the roentgenologists was "What if any are the dangers of X rays in the treatment of fibroid tumors of the uterus?" Practically all the answers indicated that the only danger to be feared was the production of an X ray dermatitis. Every one, however, emphasized the fact that this could be done only by skillful hands. The operator was not

THE PREVENTION AND TREATMENT OF PELVIC ADHESIONS<sup>1</sup>

BY P. STRASSMANN, M. D., L. L. D., BERLIN, GERMANY

**A**DHESIONS in the region of the pelvic peritoneum involve the surroundings of the uterus and its appendages, the pelvic colon, the omentum and the bladder. Adhesions are most frequently found in the pouch of Douglas, which is the deepest point of the peritoneal cavity and thus serves as a cesspool into which effusions and other inflammatory products drain. The appendages of the uterus form the lateral and superior boundaries of this pouch. Adhesions around the bladder anterior to the genital organs, are more rare, for the alternate filling and emptying of the bladder serves to smooth them away by mechanical action.

The importance of pelvic adhesions lies firstly in the pain which they produce, secondly in impairment of function chiefly of the genital organs but which also involves the neighboring organs. The most noticeable symptoms are lower abdominal and lumbar pain, painful defecation and coitus and not infrequently gastric pain especially if we have to deal with oriental adhesions, which are always difficult of recognition. In such cases the tongue and gastric contents are unaltered. Later menstrual disorders appear. These are caused by stretching of the adhesions as a result of the menstrual swelling of the uterus. This may in part be attributed to ovarian pain, since the adhesions check the maturation and rupture of the follicles and render free extrusion of the ova impossible. Should the tubes be involved in the adhesions, pain will be present at other than menstrual periods in the form of retention colic and stricture pain. Finally these women are frequently sterile.

A adhesions may occur as the result of bacterial infection which may find its way (a) through the tubes e. g. gonorrhea and puerperal infections (b) through the wall of the uterus first, by way of the lymph-channels, as may occur in puerperal sepsis second direct, e. g. following perforation by sounds (c) by way of the appendix abscesses of

which readily gravitate to the pelvis. If cases showing severe inflammatory changes in the appendix are not operated upon in time the result may be suspended fertility and incurable adhesions in the pouch of Douglas. (Tuberculous diseases do not come within the scope of this paper.)

B Adhesions may arise from effusions not in themselves infectious e. g. hematoceles and hematomata. Adhesions here are protective elements which check hemorrhage and limit the further extension of the products of effusions. This is nature's treatment and promotes the organization and absorption of the blood-clots. In reality this type of healing by encapsulation is frequently followed by worse results than would be the case after surgical removal since the proper artificial emptying generally leaves fewer adhesions. In cases of tubal pregnancy operation restores the fertility far better than does spontaneous absorption. In cases of tubal rupture pregnancies follow operative treatment much more frequently than they do after spontaneous absorption.

C The third group is due to mechanical causes (1) Friction of tumors chafing etc. Ovarian tumors are intraperitoneal formations which can develop freely in the abdominal cavity. Malignant tumors are more frequently followed by adhesions than either the benign type or ascites. Adhesions due to benign tumors keep pace with the increased growth. Adhesions may also follow unskillful use of the trochar. Intraligamentary growths give rise to fewer adhesions.

Dermoids and teratomata even when small injure the peritoneum through the foreign nature of their contents. This is of great importance. Adhesions to the intestine allow the bacillus coli communis to penetrate the dermoid sac and thus lead to infection and suppuration of the tumor.

Necrotic tumors and strangulated tumors with injured pedicles give rise to still more serious adhesions. Even a strangulated

from their answers, undoubtedly classed the gynecologists as doubting Thomases, as they expressed the opinion that the need of the gynecologist was to testify that a tumor had been present before treatment.

It is interesting to note that the various complications which render X-ray treatment unsuitable are the very ones that are responsible in a great measure for the high mortality rate of hysterectomy. In plain words, surgery has to assume the responsibility in the very serious cases which the X-rays would make worse. I venture the assertion that the mortality from hysterectomy in competent hands, in the uncomplicated fibroids of the uterus would compare very favorably with that of uncomplicated appendicitis. If the complicated cases were eliminated from surgical statistics, there would be little reason to advocate anything to supplant it.

The most important question in this whole subject is that relating to a consideration of the various phases of malignancy associated with fibroid tumors of the uterus. Probably the most important paper on the subject is that of Miller (5). It is practically impossible to estimate with any accuracy the frequency of malignancy as a complication of uterine myoma. Miller gives a table taken from the reports of many authors and arrives at the conclusion that sarcoma occurs in but approximately 2 per cent of cases. There is no mention made of the frequency of carcinoma which McDonald estimates as 3.7 per cent. As previously stated, I asked the surgeons how often they had found malignant degeneration in fibroid tumors. The answers varied, but the average frequency was about 5 per cent. I am perfectly satisfied that if a thorough routine pathological examination was made of every fibroid removed we would find the incidence of malignant disease much higher than reported and consequently the frequency of recurrence after operation much less. In a personal communication, Dr. Stephen E. Tracy who has made such a study in his own cases tell me that he has found associated malignant disease positive by histologic study in 10 per cent of the cases.

Miller's conclusions are as follows:

1 Sarcoma may be said to occur in about 2 per cent of all myomatous uteri.

2 The primary mortality of operative myoma therapy is still about 4 to 5 per cent.

3 A lasting cure of sarcoma of the uterus by the operative treatment can be expected only in 25 per cent of the cases at the most.

4 Considering the advantages of the X-ray over the operative treatment in regard to assured freedom from fatality mistakes in the diagnosis of sarcoma amounting to 0.8 per cent make little difference.

5 When the public learns that not every tumor of the uterus demands operation, but that there are also efficient conservative methods, we shall certainly be in a position to get hold of more malignant growths in the curable stage.

In view of the above facts, I believe there can be no further doubt that a routine operative treatment of myoma of the uterus, for fear of sarcomatous degeneration need not be carried out. The ghost should be buried at once.

These conclusions are specious, but they are not justified. Admitting that sarcoma occurs in but 2 per cent of cases and that the mortality of hysterectomy is 5 per cent, surgeons are not getting that mortality because they are operating on account of the fear of sarcoma alone. Sarcoma uncured is not the only thing that kills these patients. What about carcinoma, necrosis, infections, torsion of the pedicle, intestinal adhesions and obstruction, and all the other complications that may occur? The reason we have such a high surgical mortality is that we have to operate in grave emergencies in many cases in order to save life. It is not fair to compare the total surgical mortality with the incidence of any one complication and to say that because the complication occurs less frequently than the mortality the treatment should be discarded. These conclusions, of course, do not vary the in a many ways but the application of the principle means just this. Particular exception is taken to Conclusion 5. I take just the opposite view for I believe that as soon as the public learns of such a teaching, they will not submit to surgery but

<sup>5</sup>The Relation between Sarcoma and Myoma of the Uterus and Its Bearing on X-ray Therapy of Uterine Myoma.

will delay operation until the growth has so far developed as to be inoperable. I read this conclusion to mean that the cases of malignant degeneration will come to the *röntgenologist* for treatment while the growth is still in the curable stage. If my understanding of the statement is correct then it means in no uncertain language that surgery is to be eliminated in all cases of malignant disease of the uterus, forsooth because the primary mortality of operation is higher than the primary treatment by the X ray. If this is true of the uterus then it is true of malignant disease of every organ of the body. I have the greatest regard for the efficacy of radiation in the treatment of cancer but I believe there are but few men who would have the temerity to discard surgery in the treatment of malignant disease. Surgery is not ideal in the treatment of cancer but it is far and away superior to any other method of treatment in the early stages of the disease.

The question of the limitations of the two methods is worthy of discussion. Surgery is, practically only limited by the general condition of the patient. Röntgenotherapy on the other hand, is limited to a great extent by conditions in the tumor itself. The various complications offering contra indication have already been mentioned. Another contra indication to the use of the rays is the age of the patient. Most authorities are in accord that the best results are obtained from irradiation in women at or after the menopause. In a woman under forty the X ray treatment is, generally not applicable for the reasons that recurrences are apt to occur that it takes too long to abolish symptoms and is therefore too expensive and that it means sterilization of the woman. On the other hand, this is the most favorable time for surgery. If all fibroids were operated on early before the various heart changes had taken place and before the various degenerations and complications in the tumor had manifested themselves, the mortality would be one per cent or less. Again, it is often possible in the young woman with an uncomplicated fibroid to save her ovaries and enough endometrium to preserve for her the menstrual function. It should be unnecessary to say anything in reference to

the treatment of the small pedunculated submucous polyp and the small growths that can be cured by myomectomy with the preservation of the fecundity of the woman. Here it must be admitted that surgery is in a class by itself.

It may seem that I am unalterably opposed to the use of the X ray in the treatment of fibroid tumors of the uterus. Such a conclusion is far from the fact. As I stated in the first part of my paper I believe it has a most important place in our therapy. In order to establish this field the following question was asked both the surgeons and röntgenologists.

Under what circumstances do you advise the X ray in preference to surgery? Seventeen out of forty four surgeons who replied answered that they never advised it under any circumstances. The general context of the other answers from surgeons was that it was to be advised when the woman as a result of serious heart or kidney disease or grave anemia, was a poor surgical risk. The replies from the röntgenologists expressed a variety of opinions. Several stated that they always advised it in preference to surgery others that they never advised it in preference to surgery when surgery was possible and acceptable still others, when no complications existed that would require surgery and contra indicate the use of the X ray. A few would advise it only after the age of forty in uncomplicated cases. The consensus of opinion seemed to agree with that expressed by the surgeons that its greatest field of usefulness was in those cases where surgery would be particularly hazardous.

Apparently there is no question as to the value of the X ray treatment in certain classes of fibroid tumors of the uterus. It has been definitely proved that röntgenotherapy has, with but few exceptions controlled bleeding from myomas and has also reduced the size of the tumors in a certain percentage of cases where it has been used.

Many women with fibroid tumors of the uterus are poor surgical risks on account of anemia or associated heart, kidney pulmonary and other general pathological conditions. To operate on many of these cases is to take an unnecessary risk when we have a method

which, even if it does not cure at least will relieve dangerous symptoms. We realize that in many cases so treated the dangers of future development are present in spite of treatment but we take the chance of betterment on account of the grave danger to life from an operation. Again we find many women, and we will find many more in the future, who refuse surgical intervention. These should be subjected to X ray therapy for the reason that in competent hands the possibility of being benefited is much greater than if nothing were done for them. In the gravely anemic cases the X ray should be

used to control the bleeding and enable the patient to get into proper condition for surgical intervention.

#### CONCLUSIONS

1. Surgery is the best treatment in fibroid tumors of the uterus and cannot be supplanted by any other known form of treatment.

2. Rontgenotherapy has an important place in the treatment of these tumors.

3. Surgeons and rontgenologists should not enter into competition with each other but should work hand in hand for the relief of womankind.

## STRANGULATED EPIGASTRIC HERNIA

B. ALFRED MOSCOWITZ, M.D., New York City

Professor of General Surgery, Columbia University; Assistant Surgeon, Mount Sinai Hospital; Visiting Surgeon, New York Hospital.

**I**N an article entitled "The Pathogenesis and Treatment of Hernia of the Linea Alba" which appeared in *SURGERY, GYNECOLOGY AND OBSTETRICS*, April 1914, I made the statement that "strangulation is exceptionally rare in epigastric hernia but that it can occur is amply proved by an interesting report by Hotchki."

Less than one month after the publication of this statement such a case came under my observation.

II. C., 49 years of age, Russian a tailor by occupation, was admitted to my service in Mt. Sinai Hospital, May 5, 1914. For the past eighteen years the patient noted a swelling which was located midway between the xyphoid cartilage and the umbilicus. The swelling was soft, the size of an orange and at times disappeared until only a small portion of it remained visible. Operation was suggested to the patient but was declined. Five days prior to his admission to the hospital the swelling suddenly became larger, very painful and tender. The skin covering it became hot and red, nor could he reduce its size by the customary manipulations. At no time did he vomit, but his habitual constipation was aggravated. The tem-

perature at the time of his admission was 102.5 F. with a corresponding increase in the pulse rate. Other symptoms were entirely absent; indeed, his general condition did not suggest any serious malady. Upon physical examination the abdomen was found to be moderately distended but this disappeared after a high enema, which was followed by a copious evacuation. Midway between the xyphoid cartilage and the umbilicus—not in the median line, however, but overlying the right rectus—there was a very firm mass about the size of a small grapefruit. This mass was apparently located within the abdominal wall. The overlying skin was reddened, almost erysipelatous in appearance and apparently adherent. There was no mobility whatever upon the underlying structures.

The diagnosis was rather doubtful. There seemed only two possibilities, either a strangulated epigastric hernia or an intramural abscess of the abdominal wall. The history of a preexisting mass favored a strangulated hernia, but the absence of all general symptoms apparently negated such a possibility. The phenomena of acute inflammation were so pronounced that the

diagnosis of an intramural abscess of the abdominal wall seemed most probable.

*Operation* May 6th Exposure through a five inch incision retraction of the skin and subcutaneous fat revealed at once a strangulated hernia that had escaped from the abdomen through a circular aperture in the linea alba, about one inch in diameter. After incising the peritoneal sac some bloody fluid escaped the prolapsed contents were tense smooth, and ordematous, so that at first sight it seemed as though the contents were either the colon or stomach. The mass covered the hernial opening like a mushroom so that the division of the constriction was difficult. When this was done the mass was found to be made up of prolapsed and strangulated omentum. This was ligated in chain ligatures and removed. The mass removed was the size of an orange. After reduction of the stumps, there was seen another somewhat smaller mass of fatty tissue just above the sac, but closely adherent to it. Closer examination revealed a continuation of this mass with the fat situated between the two layers of the falciform ligament of the liver. The fat was inflamed and in consequence was extirpated. The redundant portion of the sac was cut away and the wound closed by overlapping its two margins. A separate counter incision was made for drainage. Patient made an uninterrupted recovery and was discharged cured.

Thus far there have been recorded the following ten undoubted cases of strangulated epigastric hernia.

1. Fabre (These de Paris 9) The hernial contents were composed of omentum and almost the entire transverse colon.

2. Janner and Berger (Presse Medicale, April 9) The hernial contents were small intestine.

3. Sebbas (Deutsche Medizinische Wochenschrift, October 8 9) The hernial contents were small intestine.

4, 5, and 6. Rogers (British Medical Journal December 7 9) reports three cases. 1. one case the contents were the transverse colon in another case the contents were small intestines and in the third case the contents were transverse colon and omentum.

7. Gussenbauer (Virchow Hirsch Jahresbericht d. Gesamten Medizin, 876 11) The contents were small intestines.

8. Hotchkiss (Annals of Surgery xiv 78) The contents were omentum and small intestine.

9. V. Klein (Graef and Walther, Journal der Chirurgie und Augenheilkunde, Berlin, 1820 p 445) The contents were transverse colon.

10. Dieffenbach (Operative Chirurgie Leipzig 1848 ii 66) This case very probably was a strangulated hernia the contents were omentum and small intestine.

Some of the articles published refer to a publication by Wiesinger and credit him with two or three cases. Careful study of his article however has failed to convince me that any of the cases he reports were true strangulated epigastric hernia. Nowhere in this article except in the title is mention made of a hernia of the linea alba as I understand such a hernia to be. I am not even convinced that they were hernia but granting even that they were it is more than probable that they were of the umbilical variety. Additional corroboration of this surmise is found in the ages of Wiesinger's patients, namely 17, 8 and 5 years respectively. In fact, if my understanding is correct, Wiesinger's main purpose was to call attention to the point that it is possible to have in these hernia a strangulation of only a part of the wall of the intestine i. e. a so called Richter's hernia. After careful consideration it seems wisest on the whole to place Wiesinger's three cases in a doubtful class.

Udén publishes a case which may have been a strangulated epigastric hernia. In addition he also collected all the cases, thirteen in number which have appeared up to the date of his publication, some dating as far back as 1797. Of all these cases, however only the two cases reported by V. Klein and by Dieffenbach may be regarded as valid. Critique of the original articles leads me to the belief that the remaining cases were of the umbilical variety.

The rarity of strangulated epigastric hernia becomes obvious when the pathological anatomy of epigastric hernia is taken into consideration. In the paper already referred to I laid down the principle that the majority of epigastric hernia are not hernia in the true sense of the word but merely prolapses

of the fat enclosed within the two layers of the falciform ligament of the liver. Only a very small number of so-called epigastric hernia are hernia in the true sense of the word so that strangulation must of necessity be proportionately rare.

The case which I report is also of interest from a pathological and symptomatic view point. The hernial protrusion was made up of two distinct portions. One the upper and smaller one was distinctly extraperitoneal and composed of the fat situated between the two layers of the falciform ligament of the liver. This confirms the contention already stated in regard to the pathogenesis of these herniae. The second the lower and larger one was composed of omentum, which had become strangulated within the hernial sac.

The explanation of the succession of events in this case is the following. At first there was merely a protrusion of the fat enclosed between the two layers of the falciform ligament of the liver. In the growth of the hernia, only the left leaf of the peritoneal surface of the falciform ligament was pulled out in the form of a sac, in which omentum became lodged. Strangulation was the final event.

The symptomatology and prognosis of strangulated epigastric hernia does not differ from that of any other hernia similarly strangulated. In our case the symptoms were so trifling and evanescent as to lead in part to a faulty diagnosis. Only the consideration of the possibility of its being a strangulated epigastric hernia led to a careful execution of the operation and the successful outcome.

## UNTOWARD RESULTS OF PYELOGRAPHY

B. MARTY KROTOSZYNSKI, M.D. SAN FRANCISCO

WITH the advent of the newer methods of examination the diagnosis of pathological conditions of the genito-urinary tract at once assumed an aspect of precision and scientific exactness. The clinical picture, the examination of urine, cystoscopy, ureteral catheterization, the determination of renal function and radiography are the methods at our disposal to day which if carefully and intelligently applied, suffice in the great majority of instances for the diagnosis of an existing lesion.

It is nevertheless true that not all problems of renal pathology can be solved by these means. Especially those lesions that are not characterized by an appreciable deterioration of renal function may require for their correct recognition a demonstration of their anatomical abnormalities, on the basis of which exact conclusions as regards contemplated measures of treatment might be formulated. Such a definitely anatomical diagnostic method is furnished by pyelography, the technique of which has been rapidly perfected so that the pictures provided by this means may render

the diagnosis as exact and convincing as an anatomical specimen. In fact, every experienced renal surgeon has encountered cases in which the *prima facie* evidence produced by pyelography represents the most important factor in the construction of a difficult diagnosis.

It is therefore not surprising that pyelography rapidly became a method of routine examination at the hands of many renal surgeons. Characteristic of its extensive use at large and progressive surgical centers is Brausch's (1) report from the Mayo clinic, based upon more than 500 pyelographic exposures during a period of three years. Briefly stated Brausch's conclusions are that pyelography if correctly applied, is not connected with any permanent injury that the objections to the method, as being dangerous and painful, are trivial and that it should be used without hesitancy in lesions of the genito-urinary tract with doubtful or perplexing diagnostic features. The harmlessness of pyelography was again accentuated by von Lichtenberg and Diellen at the sixth Röntgen

Congress in 1910. Equally favorable though somewhat more guarded as regards its scope of application, is the opinion of Voelcker (2) who considers pyelography. If carefully done and particularly if applied in cases of chronically enlarged renal pelvis, an almost painless procedure that is never followed by permanent lesions.

It is not my purpose at this time to dilate upon the technique and the diagnostic possibilities of pyelography. I merely wish to discuss the untoward results and dangers of the method which may occur in spite of the utmost care in its application and in this connection I beg to report the following observation.

A man of 36 had suffered for several years past from digestive disturbances and intermittent attacks of right-sided abdominal colic associated with vomiting. He entered the hospital while suffering from one of these attacks where a urinalysis demonstrated a considerable amount of microscopic pus and blood. He was therefore transferred to my urological service.

Physical examination neg. to kidneys not palpable. Hydrocele of moderate size on left side. Cystoscopy neg. The ureter on the left impeded on the right side at a point about 6 cm. from the renal pelvis. After bilateral catheterization urine flow apparently under pressure and in a continuous stream from the right side the patient became more comfortable after vaccination about 2 m. Microscopically the right-sided secretion shows a number of pus cells some of them in clumps, fresh blood squashed and thick. Various and irregular epithelial cells. Numerous and irregularly shaped cells. The fluid demonstrated a uniformly marked leukocytosis of renal function of the right side (sugar, albumin, globulin, azo, etc.) in the urine and in the minute amount of the kidney the quantity of pus cells in the urine only a trace of pythiosis. No leukocytes in the right-sided urine.

The secretion from the left kidney proved to be microscopic all sedimentation normal. No leukocytes in the urine.

I am indebted to Dr. Wm. H. J. for the report.



Fig.

upon the bacteriological examination of urine from the right kidney.

Smear shows many polymorphous nuclei, leukocytes and lymphocytes, some large phagocytes, a few gram-negative bacilli, a few small gram-positive diplococci, several groups of extremely small gram-negative bacilli (smaller than influenza bacilli). On culture no visible growth, a smear shows many extremely small bacteria. No tubercle bacilli found in spite of careful search.

Pyelography was now made by injecting 10 c.c. of a twenty-five percent freshly prepared and lightly warmed aqueous cargeol solution into the right pelvis. A usual injection was made through a small liberal (No. 5) bi-muth catheter and the main large glass syringe of 20 c.c. positively the needle of which touched the end of the catheter. The piston of the syringe was used under gentle pressure to start the flow and the fluid was allowed to enter the renal pelvis by hydrostatic pressure by lifting the syringe as much as possible above the level of the patient's bed. In this manner the injection was continued during the process of taking the picture, while thickened silver solution was seen to flow from the

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Fig. 3

Fig. 3 Masses of silver in tubules. Marked cellular infiltration of adjoining parts of renal tissue. The cells are partly polymorphonuclear leucocytes of which some are found in the tubules containing the silver. There are also many lymphocytes in certain parts of the field. The connective tissue cells show marked evidence of proliferation leading to atrophy of many tubules in the affected area. B & L. Obj.  $\frac{1}{3}$  Oc. I.



Fig. 4

Fig. 4 Several straight tubules full of silver. Surrounding tissue necrotic, full of hemorrhages, infiltrated with polymorphonuclear leucocytes & lymphocytes. Infiltration and recent proliferation of connective tissue. B & L. Obj.  $\frac{1}{3}$  Oc. I.



Fig. 5

Fig. 5 Area of destruction in renal tissue with liquefaction of necrotic tissue and formation of a septic abscess. Cellular proliferation of the connective tissue about the abscess cavity. B & L. Obj. Oc. I.

damaged by collargol injections and the presumption is justified that not all cases of injurious effects of silver salt injections for pyelographic purposes have been brought to the notice of the profession through publication.

A fatal accident in connection with pyelography was first reported by Roersle (6). In his opinion death in this instance was due to acute argyria through collargol poisoning, since certain symptoms observed in that patient prior to death tallied with the clinical picture of acute silver toxicemia. I have made a similar observation in a weak and cachectic woman of about 40 in whom, shortly after the injection of a small amount of silver solution into the renal pelvis, omitting cyanosis, diarrhea, and slight hematuria connected with attacks of almost uncontrollable excitability ensued. No autopsy could be obtained in this case but I have no doubt of the logical connection of this symptom complex with the silver injection.

Rosenblatt and Margoules (7) report the case of a man 45 with sudden collapse during the injection of 40 cm. of five per cent collargol. Death occurred fifteen hours after pyelography and was due to perforation of the renal pelvis.

I have at a recent meeting of the American Medical Association (10) in discussing the subject of early hydromyrosis, mentioned the case

of an old cachectic individual of 73 in whom one week after pyelography by means of injecting a few cubic centimeters of a twenty per cent argentes solution, at the autopsy severe parenchymatous lesions of the injected kidney were ascertained. Besides these graver lesions I have like others repeatedly observed after pyelography pain on the injected side, rise of temperature lasting several days, and occasionally nausea and vomiting. On account of the frequency of these symptoms soon after pyelography Voelcker and von Lichtenberg advised the preliminary administration of morphine hypodermatically — an inadvisable step because eliminating pain which is the most important danger signal of too high pressure during injection.

Distressing symptoms after pyelography are in all probability due to the fact that the silver solution quite frequently penetrates into the urinary tubules and thus causes parenchymatous lesions of either light and temporary or of more serious and permanent character. If these lesions as in most instances, are insignificant the integrity of the kidney after the disappearance of all subjective symptoms becomes readily re-established. No trace of the silver salt injected a few days previous to nephrectomy could be ascertained in number of kidneys of my cases, and a careful microscopic examination of sections did not demonstrate any evidence of damage done



Fig. Hemorrhagic areas on

evacuating shaft of the cystoscope which had remained *in situ*. At no time during and after the pyelographic procedure were any marked untoward subjective (pain) or objective (fever) symptoms noticeable. The pyelographic plate (Fig. 1) showed a narrowing of the right ureter beginning at a point about 1.5 cm. below the renal pelvis and extending about three cm. downward and a moderate dilatation of the canal above and below this area. The ureteropelvic juncture appeared to be angulated and the renal pelvis and upper calices dilated. No dysplasia of the kidney could be ascertained from the plate which obviously demonstrated the existence of a moderate hydronephrosis probably due to ureteral stricture.

At the operation three days after pyelography the exposed right kidney showed on its surface a number of dark colored areas of various size which projected slightly over the surrounding tissue. At the upper pole of the organ the tissue was upon palpation softened and flabby. The ureter entered the enlarged pelvis under an angle. The incised organ showed on its cut surface well defined grayish white nodular area resembling caseous spots and some dark brown necrotic foci like those on the surface. A particularly large necrotic focus was visible at the upper pole. The calices were moderately dilated.

On the basis of these findings and the previously ascertained satisfactory condition of the left kidney the right organ was removed. The patient made an uneventful recovery.

Dr. Ophila's pathological report is as follows:

Kidney of nearly normal size. Surface slightly granular especially along convexity. There

are also several star shaped scars of moderate size.

On the surface of the organ one sees very many minute hemorrhages and a considerable number of fairly well defined hemorrhagic areas which project slightly over the adjoining tissue (Fig. 2 at a). The largest one of these spots measures about two cm. in diameter. In addition to the dark red discoloration due to hemorrhage these areas show a distinct brownish hue due to the silver.

On the cut surface some of the areas are nodular in character and grayish white in color resembling caseous spots. The larger projecting spot are distinctly cone shaped with a lighter necrotic center and dark hemorrhagic periphery. On the cut surface also the brown discoloration of the tissues is very evident. Some of the areas extend through the cortex and the medulla to the renal pelvis.

Microscopically the silver is found largely in the tubules. In some places in the cortex the tubules are ruptured and the silver is discharged into the tissues. About the masses of pigment there are large necrotic foci showing beginning proliferation at the edges, where there are also extensive hemorrhages. The tissues are infiltrated with lymphocytes and in places there are large collections of polymorphonuclear leucocytes. In some parts the necrotic material is liquefied and aseptic abscess cavities have formed which are filled with polymorphonuclear leucocytes. No bacteria were found in the lesions in spite of careful search in numerous sections and in different places. No tubercle bacilli were discovered and a guinea pig which was inoculated with material from the lesions intraperitoneally did not show any lesions one month later.

The kidney shows also a moderate arteriosclerosis of the branches of the renal artery and many small arteriosclerotic scars (Figs. 3, 4 and 5).

Renal lesions of like or similar character and extension after pyelography are reported from abroad by Johnson, Jewell, Ochlecker, Troell, Zacharias and Blum. They were collected and comprehensively reviewed by Schwarzkold (3). He adds one case of his own. In this country Pennant (4) and Mason (5) have described cases in which the kidney was



by pyelography. Pathological findings, on the other hand as in the case described above force upon us the conclusion that pyelography is a rather risky method the application of which should only take place on the basis of strict indications and extreme caution.

The question therefore arises: Are the dangers and distressing sequel of pyelography offset by its diagnostic advantage?

In the case reported above no unusual diagnostic difficulties were present that could not have been overcome without pyelography. The history, the clinical and cystoscopic findings including the character of the urinary spurt, the definite functional debility and macroscopic aspect of the right-sided renal secretion made the diagnosis: Infected hydronephrosis—highly probable and on the basis of negative plate and bacteriological evidence (nephrolithiasis, tuberculosis) sufficiently exact to warrant the operative exposure of the affected kidney. The operative formula, though of the character of the operation, whether plastic (nephroplasty, nephropexy) or radical (nephrectomy) became feasible only through pyelography which at once gave the correct conception of the size and shape of the renal pelvis and calices and what is more important of the relation of the existing ureteral abnormality to the kidney.

L. crybids possessing personal experience with the plain pictures produced by pyelography will agree that in no other way can the topographical relation of the kidney, its pelvis and ureter to other organs of the abdominal cavity be ascertained. This method moreover has proved to be of such inestimable value especially in the correct recognition of beginning mechanical renal lesions, resulting in dilatation without functional disturbance that we cannot afford to miss it in our urological diagnostic armamentarium.

It would therefore be extremely regrettable if pyelography should become discredited or by being stigmatized as a harmful and dangerous, fall into disuse. It has undoubtedly in our first enthusiasm been applied indiscriminately and unwisely without due regard to the technique prescribed by its originators and on individuals with inadequate resistance. A careful and critical pe-

riusal of the rapidly increasing literature upon the dangerous and distressing sequel of pyelography does not permit of binding conclusion as regard their real cause which apparently is not represented by the quantity concentration or choice of the shadow casting preparation (collargol, caryopterol, argyrol, etc.). Undue pressure in injecting is in all probability responsible for many bad and distressing results. Fatal accidents, on the other hand have occurred in spite of apparently faultless technique and in two instances, after the injection of a silver solution of low concentration (four and five per cent collargol). Moreover the very large number of pyelographies without any subsequent injury permits of the conclusion that an unknown and accidental and possibly avoidable agent must play an important role in the occurrence of untoward result. Many mooted questions in connection with pyelography will undoubtedly be settled sooner or later on the basis of experimental work as started abroad by Strömman (11), Blum (12) and Schachnow (13) and as lately taken up by Eversdrath (14) in this country. Meanwhile it behooves us to draw strict attention to the application of pyelography to limit it to those cases in which the existence of a dilated renal pelvis appears to be highly probable through other means of examination and to perform it with the greatest possible caution.

#### CONCLUSIONS

Though pyelography is justly considered as of definite diagnostic value in some renal lesion (dilatation of renal pelvis and calices without functional disturbance, malposition of kidney, etc.) a correct diagnosis of the great majority of surgical kidney conditions is nevertheless feasible without this method. The general acceptance of strict contraindications to pyelography is the more indicated since it is proved that solutions, though brought into the kidney pelvis with faultless technique and without undue pressure may penetrate into the tubules and the surrounding kidney tissue and cause serious inflammatory lesions resulting in necrotic foci.

Pyelography should therefore be restricted to those comparatively rare cases in which

some of the more serious problems to be met with in the excision of a gastric ulcer.

It may be safely stated that as a general rule the chief difficulty is not the removal of the ulcer except when located high on the lesser curvature, but rather the satisfactory closure of the opening thus made. The treatment of gastric ulcer by excision and suture with or without gastro-enterostomy may be a formidable operation even in the hands of experienced surgeons, and one which entails considerable risk to the patient.

The most immediate post-operative dangers are those of hemorrhage and impaired gastric motility incident to interference with the nerve supply in extensive excisions along the lesser curvature. Later complications are usually due to the deformity resulting from contracture at the point of closure.

Hemorrhage occurring late, that is after the seventh or eighth day is occasionally of serious consequence. The condition is somewhat deceptive in that the bleeding is not profuse but persistent, and may result fatally as has recently

occurred in our clinic, in which case a secondary gastro-enterostomy and transfusion of blood failed to prevent a fatal issue. The autopsy in this case showed that the mucous membrane had separated and left a large denuded area from which the bleeding had taken place. Such a complication at such a time is probably dependent upon the fact that after the excision of the ulcer there is a marked tendency of the mucosa to retract, and the tension required to approximate it may predispose the sutures to give way during the second week.

In observing the seriousness of these complications, particularly of late hemorrhage, it occurred to the writer that some method might be devised whereby the ulcer could be destroyed in such a manner as to obviate any possibility of hemorrhage, either early or late, without removing an appreciable amount of healthy gastric wall. That this could be accomplished by the actual cautery seemed obvious. The cautery is one of the most satisfactory methods of dealing with many superficial ulcerations early epithelioma certain forms of carcinoma (cervical, buccal

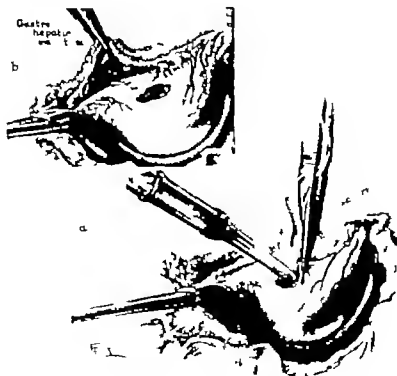


Fig. (a) Removing out ulcer (b) Ulcer burned completely through

tumor may exceptionally retain its nutrition e. g. when it is enveloped by omentum.

(9) Myomata, as is well known rarely give rise to adhesions. When well nourished, they are invested with smooth peritoneum. The only myomata capable of producing adhesions are of the subserous variety those undergoing necrosis as a consequence of a twisted pedicle, or the same presenting infarcts or the results of intestinal infection.

D. Undoubtedly even healthy organs when displaced can produce adhesions. Retroflexed uteri may exist for years without adhesions, and even here in many cases these should be attributed to infections. However adhesions may arise without infections—that is to say first, due to the pressure of an ill-fitting or incorrectly placed pessary second through the development of small myomata third through the agency of ovarian hemorrhages. The clinical picture and the symptoms of retroflexion are primarily referable to the torsion of the ligamenta lata. This produces a varicocele in the broad ligaments, the ovary becomes hyperemic and follicular hematomata result, with more or less effusion of blood and fixation. This also applies to gynatraia, in which the aseptic contents of hematosalpinges and hematovaria produce adhesions.

L. Prolapses are rarely responsible for adhesions.

The dangers of pelvic adhesions are easily overestimated. Certainly a fixed retroflexion forms the second stage of a dislocation, which can now no longer be treated with a pessary. On the other hand, adhesions may favorably influence operative measures inasmuch as they serve to localize the operative field.

Uterus is a rare complication, for the small intestines lie well above the pelvic organs. Omental adhesions of themselves are scarcely able to produce strangulation. Pelvic adhesions and those involving the colon may easily interfere with intestinal function but they never give rise to obstruction.

It is not my intention here to speak of tumors, nor even of large pus-tubes, but I shall confine myself solely to the results of adhesions with organs, which in themselves are very little altered.

The linking of the tube inasmuch as it obstructs the passage of the ovum, may be considered as the greatest causative factor of tubal pregnancy.

Strong bands, which stretch over the ovary may produce deep furrows or may even constrict a part of the gland. A firm web around the ovary may embed it in a real fibrous envelope from which it must be freed by operation. It is quite conceivable that after such a freeing from adhesions ovulation and menstruation may be restored.

Nervous complaints, which generally accompany pelvic adhesions, deserve a word. They become especially noticeable when the local significance of the conditions is not sufficiently appreciated and the physician is led to make a diagnosis of nervousness and hysteria. Naturally the skin zone over abdominal organs is sensitive and the ovaries respond in the same way as the appendix, kidney-pelvis and gall-bladder. Every person with chronic peritoneal adhesions becomes irritable and eccentric. The diagnosis ovarie is far too often incorrectly made the same applies to "hysteria," which is only a symptom complex accompanying physical or psychical diseases. Both frequently manifest themselves in the region of the genital organs. They are either functional or really organic and at times painful and inflammatory. When the physician neither discovers nor recognizes the real cause, then the complaints increase, for the patient does not receive the correct advice regarding her mental or physical needs and the proper aid is denied her. Many years ago the diagnosis "hysteria" alone disappeared from my books. I see in the word "hysteria" nothing more than the Greek name for unrecognized conditions, against which the physician has not yet found the power either to advise or help.

It is quite comprehensible how women with unalleviated pain of long standing can be driven to suicide and Boas is right when he says that the cure of a painful disease raises the patient to a higher plane of mental equilibrium.

For the prevention of adhesions the avoidance of genital diseases is indicated. Since this generally lies beyond our power it

## AUTOPLASTIC BONE GRAFTING

WITH EXHIBITION OF LANTERN SLIDES

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MUCH healthy controversy exists to-day and an active experimental research as to the respective function of periosteum and bone in the now thoroughly established surgical procedure of bone transplantation.

On the one hand we have Arbussen and his followers and Ollier who preceded him, who hold that bone possesses its power of regeneration by virtue of its periosteum. On the other Macewen and his disciples contend that the bony graft itself regenerates the new bone by virtue of the osteoblasts within the graft itself. Again, Murphy holds that the graft is not osteogenetic, but osteoconductive.

Among research workers we have but to mention the two recent articles of McWilliams on the one side and Cohn on the other. The former contends, from his well conducted experiments that our reliance must be placed on the periosteum and the latter that our salvation depends on the bone itself regardless of its periosteum.

From time immemorial we have been taught, and I think with justice and propriety that the periosteum is the osteogenetic tissue of bone. T. Ollier who worked in the pre-aseptic period probably belongs the credit of having established the feasibility of filling in bone gaps by means of transplants. Scrutinizing the methods of Schedewitz with his aseptic blood clot and Neuber with his skin in signat on a find that these men depended probably unconsciously upon the osteoconductivity of the anatomic structures which they utilized. Senn in the use of his decalcified bone chips utilized both the osteoconductivity power of his chips together with the osteogenetic power of osteoblasts which were very probably introduced.

All of these observers have met with an element of greater or lesser success in their experiments and observations so that the impartial worker is left in more or less of a quandary as to who is right and whom he should follow in his own work. If we study diligently and calmly all of this work together with our own personal experiences, I think we should have no difficulty in arriving at a safe and satisfactory conclusion.

In the experimental work with bone and periosteum exclusively the material used has been necessarily small which I think is very important

factor in its reliability regarding deductions for its application to the practical work of filling in large bone gaps. The same holds in the case of bones, denuded of periosteum used by Macewen who broke his bone into small chips and who tells us that most of them were periosteum free in setting that some at least were covered with periosteum and others contained endosteum.

Macewen attributes to the periosteum only the power of limiting bone growth. He says, and very properly and here he strikes the nail on the head that transplanted periosteum regenerates bone only by virtue of the osteoblasts which were carried with it in the same breath he does the periosteum the injustice of saying it is only a limiting membrane. It surely seems that we are splitting hairs. In none of the experiments, whether of periosteum exclusively or bone exclusively have we gotten entirely rid of that most important physiological factor the osteoblast.

In studying the elaborate work of Nicholls on the subject of osteomyelitis we are impressed with his results. He has excised complete shafts of diseased long bones and sutured the periosteum in such a way as to create a periosteal column in which and along which the bone has regenerated to an extent as complete as the original. We have followed Nicholls in some of our own cases with similar results. We have taught persistently and I believe consistently that when periosteum retains its vitality it will regenerate new bone and in our clinical work have shown where the periosteum has sloughed there would be no regeneration.

This is well shown in the first radiograph of our second case. This picture was taken some months after the original operation for excision of an osteomyelitic tibia. At operation it was found that at the junction of the lower and middle thirds of the leg the periosteum was gone, and it was predicted at the time there would be no bone regeneration at that point. The subsequent course of the case confirmed the prediction. It might be argued that growth occurred from the ends of the bone and this is true but at the point of periosteal slough there was absolutely no regeneration.

If we study the histology of bone as Nicholls

## DEPARTMENT OF TECHNIQUE

## TREATMENT BY CAUTERY OF GASTRIC ULCER

R. DONALD C. BALLOU, M.B., T.M.D.

Notes:  $\square$  = 1000000,  $\square$  = 100000,  $\square$  = 10000,  $\square$  = 1000,  $\square$  = 100,  $\square$  = 10,  $\square$  = 1.

WHATEVER difference of opinion may exist as to the treatment of gastric ulcer, it is at least accepted as logical that the ideal procedure in our present conception of surgical treatment should be the removal of the ulcer. In a given case of gastric ulcer in any situation, except perhaps at the pylorus, the first problem to be attacked are whether the ulcer can be excised with safety, what method shall be

employed and whether the excision should be followed by a gastro-enterostomy.

It is not my purpose to discuss at this time the merit of the various principles advanced in the treatment of gastric ulcer, but rather to draw attention to a method which I believe will find a place in the treatment of at least a certain percentage of these cases. In describing this procedure, however, it may be desirable to refer to

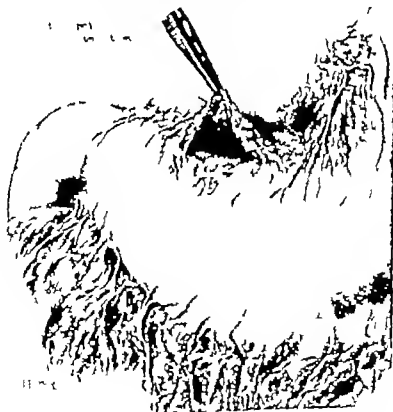


Fig. 2.  $\Delta$  in error  $M$  with generalized conceptum derived from lower rank.

**CASE.** Dora Bell was first admitted to our service October 5, 1900, suffering with chronic osteomyelitis. On October 9, 1900, the entire shaft of tibia from the upper to the lower epiphyseal junction was removed; the entire bone has since been destroyed and being found nickled. She was discharged February 9, 1901, cured. She was readmitted on November 7, 1902, suffering with a very much deformed leg due to the growth of the fibula and failure of regeneration of bone at the site of the removed tibia. The limb was in state of pathologic bowing and the foot in position of talipes equinus. During her stay in the hospital the fibula was broken and the leg straightened in order to enable her to walk. Brace ordered for her. She was admitted third time on October 9, 1903, on which occasion the work under discussion was done. X-ray plate taken October 3, 1903, shows clear outline of the broken fibula and that has been left of the tibia. It will be seen that there is slight regeneration of bone at the upper end, where the periosteum remained intact, but none throughout the remainder of the bone where the periosteum had sloughed previous to the first operation, as a result of the primary suppuration in infection.

**Operation.** October 28, 1903. Autogenous bone transplantations under anesthesia. The fibula of the affected leg was again broken to correct the recurring deformity and put the leg in the best possible position to receive the graft. An incision about eight inches long was made over the site of the previous operation; all of the scar tissue removed and adhesions liberated; the upper and lower ends of tibia were thoroughly freed and bent over them the muscular bed made snug and clean. The tibia properly resected; the graft the upper and lower ends of the tibia were shaved. Next an incision was made over the tibia of the sound leg; transverse incision at the upper and lower ends, as made with saw; the periosteum for about three eighths of an inch incised to insert these transverse cuts and piece of bone with its periosteum included in these four incisions as a graft gently chiseled off. The graft measured about 1 1/2 inches in length three-eighths of an inch in width and probably one eighth of an inch in thickness; as obvious in its thickness the hole of the osseous layer of bone to gather at its upper end with a little of the medulla. Owing to the thickness of the graft it varied. Thus straightened out, the graft placed in the bed prepared by its reception and the ends tucked into the tibial stump by means of French nails cut the proper length. Continuous catgut sutures closed the muscular tissues on the new bone. Interrupted silk suture cut and continuous silk sutures were used to close the skin. Small iodoform wick drains were used in the upper and lower ends of the wound. The wound dressings were applied and posterior guttered splint. Seventy-two hours after operation the leg was dressed and the wound contained some blood and serum. The iodoform gauze drain was replaced by some strands of silk suture cut. Four days later the wound was again dressed and on the eleventh day after operation all the sutures were removed; the limb looked well and there was no pus or blood present. On the eighteenth of November twenty-one days after operation twenty days after the next X-ray picture was taken; the wound was found entirely healed and plaster of Paris cast applied running from below the knee and including the foot.

X-ray picture N taken thirteen days after operation shows the trans-planted bone in good position. A picture of the sound leg taken on the same day shows clearly here the bone graft is removed. Regarding the treatment of the sound leg, failed to mention that the periosteum was secured with catgut suture and the external wound with B. The wound healed promptly.



Case Plate

Case Plate

Case Plate August 9, 1903. Showing amount of regeneration of bone in two months after primary operation.

Case Plate December 9, 1903. Four months after primary operation.

A third picture taken on January 4, 1904, sixty-eight days after operation shows distinctly the regeneration of bone and the graft in good position. A examination of the leg shows that the bone has regenerated decidedly; in fact, the junction of the middle and lower thirds it seems to be as large as normal tibia. Throughout the extent of the leg it can be felt well as seen by the X-ray picture that the bone is regenerating beautifully. Of course the fact of permeability of new bone to X-ray the same as that of callous must be taken into consideration in reading picture nevertheless, this picture shows clearly the new bone. It will be interesting to note during the next year or two just what developments in length as well as in thickness of the leg occurs. Inasmuch as the growth of bone occurs from the epiphysis we feel that if these have been intact the bone should grow.

The following comparative measurements in this connection are of interest.

	Before operation	Four months after operation
Anterior superior spine of ilium to malleolus	(Rt) 21 in 2 1/2 in	(L) 19 in 20 in
Circumference of leg one third	(Rt) 14 in 9 in	(L) 14 in 13 in

**CASE.** Annie Holton nine years of age was first operated for her crooked tibia June 9, 1903. The operation showed extreme involvement of the tibia, necessitating its removal from the junction of the upper and

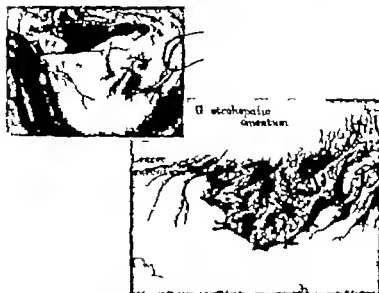


Fig. 3. (a) First row of sutures closing opening from which ulcer has been excised. (b) Ulcer area covered by gastrobepatic omentum.

etc.) by virtue not only of its destruction of tissue but also its inhibition of hemorrhage. The application of the principle described herewith was, therefore, suggested and while it has been used in the Mayo Clinic in a sufficient number of cases to warrant reporting, we are not as yet in position to state how the size, character and situation of the ulcer will affect the limitations of the method. The following technique has been employed in the cases thus far operated on by this method.

The portion of the gastrobepatic omentum in the region of the ulcer is carefully dissected free from the lesser curvature (Fig. 2). The ulcer is carefully palpated and with a Paquelin cautery maintained at a dull heat the point is slowly carried through the ulcer until an artificial perforation is produced. The moderate burning is continued until the actual area of the ulcer is

entirely destroyed (Fig. 2a). The resultant perforation is shown in (Fig. 2b). Closure of the opening is then made by interrupted sutures of chromicized catgut reinforced by mattress sutures of silk (Fig. 3a). The reflected gastrobepatic omentum is then replaced over the site of the ulcer and fixed by superficial interrupted sutures of fine silk (Fig. 3b).

In the application of this method the following facts are apparent.

1. The ulcer is destroyed and with it any early malignancy which may exist.
2. There is little sacrifice of sound gastric tissue and secondary contraction is therefore minimized.
3. Hemorrhage early or late, is with practical certainty prevented.
4. Its simplicity, speed of accomplishment and safety.

the perfectly sound leg. The patient is presented today for your inspection. The emaciation of the affected limb is due to its retention in plaster cast. Of sinking moment to us is the growth of the affected leg.

Following are the measurements taken February 27 1913 two days before the transplanting operation and the measurements taken April 21 1914 one year one month and twenty-one days after the operation.

From joint at knee to distal end of bone	Before operation		After operation	
	Left	Right	Left	Right
	11 1/2 in	11 1/2 in	17 1/2 in	17 1/2 in

The affected limb has grown in something over a year two and a half inches and the sound limb was longer by one and a half inches at time of operation, and now it is but one-half inch longer.

A further study of the skiagraphs demonstrates in Case 1 that there has been most rapid development of bone so that apparently the new bone was larger than the old. It appears highly improbable that this could have occurred alone through the medium of blood vessel development on the one hand or simple osteoblastic deposit on the other but rather to a combination of both.

In the second series we find that in spite of the destruction of a certain amount of bone, regeneration seems to have gone on uninterruptedly. And in these skiagraphs it will be clearly observed that the cortical layer of the bone seems to be developing very rapidly. In both series it seems highly improbable that any one factor singly was responsible for the bone regeneration but rather should we think that both factors have been at work.

A third patient demonstrates the fact that we should not attempt bone transplantation in acutely infected cases. It was that of a little boy who had his attack of osteomyelitis some six weeks previous. A large volume of the upper surface of the tibia was removed, and order to expedite healing the gap was filled with graft from the opposite leg. Infection occurred and the life of our little patient was threatened. The graft had to be removed in the course of about a month but the patient ultimately recovered.

Where today nonabsorbable material is being used very extensively in our bone work, especially the use of the Lane plates, I feel that work time will demonstrate that the advantage of using absorbable material wherever possible. It is highly probable that the future will demonstrate the use of bone plating rather than metal plating in Lane fracture work.



Case Plt 7 Case Plt 8  
Case Plt 7 December 5, 1913 Showing fracture  
upper end  
Case Plt 8 February 27, 1914

the work of transplants it is often possible to dovetail the extremities and use chromic catgut.

#### CONCLUSIONS

First the autogenous transplantation of bone is an established surgical procedure.

Second whether dependent for growth in periosteum or upon the graft scaffold for the development of blood vessel transplants for the present should be provided with both, particularly plates of periosteum.

Third nonabsorbable material had better be avoided where ever possible dovetailing and absorbable suture material used in between.

Fourth, it is highly probable that organized bone tissue will in the future take the place of foreign material now used in the Lane plates for fracture.

Fifth for the present thorough applicability of heterogenous grafts has not been established.



has so well done, we find that the periosteum is rich in blood vessels and keeps up the nutrition of the underlying bone. The vertical layer on the other hand, from its very compact nature is incapable of rapid blood vessel regeneration. If left, therefore in a large bone gap without its physiological prop, the periosteum it would die or prove itself a foreign body before blood-vessels would re-form. It does not, however. Murphy says, as a scaffold for the further development of blood-vessel which already exist in its attached periosteum. It is most interesting to note that in not one of Murphy's cases did he fail to transplant periosteum with his graft.

While we welcome and encourage the healthy controversy and experiments of our confreres, for all practical purposes, especially in filling in long gaps it matters not whether it be bone or

periosteum, or osteoblasts, which does the work. Successes depend upon mechanics and physiology, osteoconductivity and osteogenesis. More rapid and better results will be secured if we give weighty consideration to all of these individual factors. Bone alone is mechanically efficient but physiologically deficient; periosteum alone or with its attached osteoblasts, physiologically efficient, and mechanically deficient.

Summing up, therefore our deductions are, that long bone transplant are dependent for their success upon (1) the mechanical support of the bone itself and (2) the physiologic element of regeneration as conveyed by its periosteum, endosteum and osteoblasts.

The following two cases illustrate the practicality of the operation of bone transplantation and the apparent perfect result.

four to five millimeters. The papillae and calyces corresponding to these are absolutely free, there being no infiltrated tissue underneath them. As far as can be determined by the naked eye there are no macroscopic purulent foci but here and there small cysts.

**Microscopic examination.** Sections were cut so as to embrace the whole of the cortex and the papillae of the kidney containing areas of blackish discoloration and others were taken as controls from other portions of the kidney.

The pathological changes may be divided into those belonging to the lesion which existed prior to the collargol injections, and those which appear to be due to the presence of collargol in the tissue. As for the former the usual lesions that go with a moderate degree of hydronephrosis are in evidence. There is a moderate degree of parenchymatous nephritis, areas of fairly marked glomerular nephritis, chronic interstitial changes with connective-tissue production and here and there areas in which the effects of back pressure manifest themselves in the form of dilated tubules, boy formation, and cystic dilatation.

Collargol is present either in the form of black granules, or aggregations of blackish masses, or as very minute brown yellowish brown or blackish spots, in spaces or in the bodies of cells. The largest amounts of collargol are to be seen distributed diffusely in areas that could be regarded as streaks in the macroscopic specimen being distributed in tubules (Figs 1 and 2) in cells, in glomeruli (Figs 3 and 4) and in foci of necrosis and inflammation. Perhaps the most striking lesion is the presence of milium abscesses almost wholly in the papillae.

If in such a section we attempt to trace the passage into the kidney cortex of the collargol, we will find that the collecting tubules are but sparsely involved. Here and there the ascent of the collargol in the form of blackish masses completely filling the collecting tubules can be distinctly seen.

Where the renal tissue seems to be the most healthy, we are struck by the absence of collargol or by the fact that but very few tubules are involved. Those areas of the kidney that are the seat of a chronic inflammatory process, however, seem to be most markedly involved. If we follow the collecting tubules upward we will see that areas in the cortex corresponding to these, are frequently the site of collargol deposits, not only in the dilated tubules, but in the glomeruli themselves. In some of the tubules the collargol completely fills their lumina in others the collargol is deposited in fine black or yellowish brown

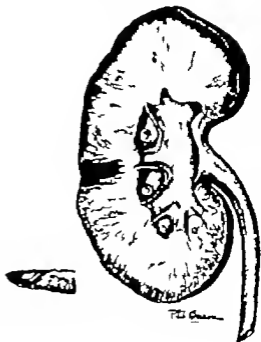


Fig. 1. Kidney in Cross-section. Areas of collargol infiltration seen in the surface of the section and in the small drawing removed for macroscopic examination.

granules in hyaline or granular casts contained in the lumina of the tubules. It is strange to note that the glomeruli which are the seat of marked connective tissue change and hyaline degeneration may also frequently contain collargol, the latter usually deposited in the form of a crescent, evidently in Bowman's capsule.

Where the collargol has reached areas of chronic productive inflammation of the kidney, there it seems to be deposited in the form of yellowish brown granules or larger masses that are partly situated in the renal tubules, but also in a large part seem to be taken by cells. Thus we find large aggregations of cells, filled with minute granules of this substance.

As for the abscesses which were found in number these contain a fair amount of collargol some of which can be traced into straight and collecting tubules entering the purulent focus.

Special stains failed to demonstrate that any of the pigment interpreted as collargol indicated the presence of hemosiderin.

Sections of the pelvis of the kidney in the neighborhood of the areas of collargol showed a moderate degree of chronic inflammation without lesions such as ulceration and without any

Sixth bone grafting should never be done in the presence of an active infection.

Seventh, most rigid vessels should be reversed

Eighth house grafts owe their vitality and ultimate success probably to the ramidity of

blood vessel development, plus the presence of osteoblasts wherever there may be

Ninth, growth in the length of bone may confidently be predicted in the case of children when the epiphyses remain intact.

CONCERNING RELATIONS WITH PYLOC RAPHY

**ELECTRIC M.D. S.A.S. Co.**

Abstract in Title Category Local Periodic Oscillations and Asymptotic in Spectral Analysis of the

THE widespread employment of the method of pyelography in the diagnosis of lesions of the urinary tract at the present time, the value of the procedure and the current belief of its innocuousness are circumstances that make it a duty — it seems to me for those who are engaged in surgical work in the kidney to record not only their success with the method but more particularly the lingering inherent in the work.

In December 1911, in examining a kidney removed ten weeks after collingol pyelography, I found distinct evidences of necrosis due to collingol in the renal pyrenchyma. These observations were however not reported *extenso*. Since then I used pyrogol almost exclusively in this work, hoping that it might be less dangerous and less destructive to the renal tissue even if it could penetrate into the renal pyrenchyma.

When therefore, less than a year ago, we encountered in which tensive nervous system in a lymphoproliferative lesions after the injection of argyrol into the pelvis, it seemed to me of some interest to record briefly the clinical histories and the pathological findings of both cases.

C. S. S. K. female, six years of age, had been operated on in October for cancer of the breast. One of the left breast glands remained and just before the operation the right breast was removed. The patient had been put on a diet of soft food and she had gained weight. The right kidney was found to be normal in the right side of the abdomen. November 1914. She was admitted to the surgical ward of the Mount Sinai Hospital and the Liberator requested me to see her. She was a stout woman.

The blunder in postal maps kept the night carrier women who reported the night carrier obstructions as met by the postal clerks in from the central office. Notes to their could be pursued. Indiscriminate appointment of other carrier concentration fees.

**Types of severe reactions:** The larvae obtained from the host is contained only 6 per cent area.

diagnosis of cerebral obstruction 9 cm from the area of  
and slight hypertrophy with demyelinated  
axonal areas of the history is made

December 11, 1971. The collared were carefully inspected to ensure the 100% better again meeting at observation point. The 100% were observed at the point corresponding to the point of arrival at observation point. The 100% were observed at the point corresponding to the point of arrival at observation point. The 100% were observed at the point corresponding to the point of arrival at observation point.

On Thursday, 5th Dec, Lubalowski exposed the series with the low of performance plastic operators but found 5th be better on raised level in inflammatory bone over considerable extent of 6 weeks that employment was more tolerable suitable. This was carried out as the 1st item was for the laboratory for examination.

Microscopic examination of peritoneal washings and the gross appearance of the kidney were as follows:

The kidneys slightly enlarged with both the pelvis and the ureter moderately dilated and saccular (fig. 1) On stripping the capsule the middle of the convoluted border and posterior surface show a number of blackish areas surrounded by light congestion. These measure from four to eight millimeters in diameter and correspond to wedge-shaped streaks of blackish color extending through the cortex about to the base of the pyramids. A smaller number of similar blackish areas are found along the convoluted border near the superior pole. Upon section of the kidneys through these areas blackish mottling is seen to extend almost to the base of the papilla where they seem to disappear. Posteriorly their broadest extent being at the surface of the kidneys. The tips of the papillae and the corresponding calyces show no sign of collagen.

The renal areas of bla. hsh discoloration near the supra renal differ from those just described in that they do not seem to extend down as deeply at the kidney or up as a portion just under the capsule not extending into the cortex toward the papilla for distance of from

remains only for us to act so opportunely and correctly that changes in the parametrium and peritoneum cannot occur. Even here we are to a certain degree limited. For we know that adhesions in many cases are consequences which one may not disturb with impunity. The agglutinated mass, e. g. consisting of uterus and adnexa, forms a protecting barrier against the spread of the infection to the general peritoneum. Sad are the results when the sticky protective adhesions consequent upon a recent gonorrhoea or puerperal infection are too soon broken up. A violent peritoneal reaction follows, which means that there is a renewed and greater effort to again encapsulate. It can be just as fatal when a recently infected uterine appendage is removed by abdominal section. Here a general peritonitis often follows the unavoidable flow of pus into the abdominal cavity. In such cases the reference to an "old gonorrhoea" or the statement that "everything was previously infected" may pass current with the laity. But from the standpoint of a conscientious medical man it is not sufficient. *Cellulitis stump crinales omentalis adhesions* and even *stercoraria* militate against the success of the operation. Although the patient may recover from the operation still the complaints continue. Discontent, nervousness, eventually hysteria and finally perhaps attempts at suicide result.

For many patients, timely operative intervention is the best course to pursue in order to preserve functioning genital organs or to avoid changes leading to disability, despair and nervous disturbances.

The acute inflammatory diseases of the adnexa may indeed abate in a few weeks but they often lead to relapses and to highly dangerous forms as for instance after criminal abortion, when the violent early symptoms of a beginning general peritonitis demand prompt relief. The inflammatory products must have another outlet in order to secure quick healing if possible and secondly to avoid the formation of abscesses in the tube and ovary and perhaps a lingering illness. The opportune opening of the posterior fornix and drainage of the pouch of Douglas

is far too seldom employed. It is not a dangerous procedure and should be undertaken in the above mentioned cases just as paracentesis of the ear-drum is done for middle ear inflammation. It has proved in various cases of pelvic peritonitis following artificial abortion to be a life-saving measure and has many times prevented the formation of large tubal abscesses. I can heartily recommend it as a simple harmless procedure which promises every success.

Of greatest importance in the formation of adhesions is excessive intra uterine treatment by means of curetting, local applications and douches, in cases of gonorrhoea or puerperal infections. Also the forcible correction of displacements by sounds being a cause of adhesions, must be condemned. Perforations of the uterus occur much more frequently than is commonly believed, which fact is well known at all great clinics and hospitals. Moreover in uteri of patients who were not aware of inflammatory processes a stellate scar is not infrequently found on the fundus or posterior wall during operations for retroflexion—a sign of a previous but fortunately aseptic perforation.

Inflammations of the appendix demand timely operation and cases with pelvic abscess should be drained through the posterior fornix. The fact that chronic inflammations of the appendix, especially in women, should be operated upon and not left to themselves needs only to be mentioned here.

I maintain that hematomata in the pelvis should be emptied on principle and moreover through the vagina, since this is the natural outlet of the pelvis. This includes not only hematomata resulting from tubal pregnancy but also hematomata of the ovary. The diagnosis of these is not easy and one should always think of them in obscure cases. If in retroflexed uteri adnexal swellings with pain occur if near a myomatous uterus sensitive nodules are to be felt and if with this newly formed resistance no fever exists, then we have to deal with hematomata.

Small growths of the ovary should never be overlooked. This applies especially to small dermoids, since adhesions involving these and giving rise to the diagnosis oophoritis and



Fig. 1. Photomicrograph showing collagen in glomeruli and tubules. For the photomicrographs I am indebted to Dr. I. S. Mandelbaum, Pathologist Mount Sinai Hospital.

extravasation of collagen under the pelvic mucous membrane.

It is of interest to note that, where small amounts of collagen are present in the collecting tubules, or in the constricted tubules, no necrosis is induced by its presence. Furthermore this substance does not seem to have produced any marked inflammatory reaction in places where it is present in small amounts. On the other hand, in the region of the abscess, and where large amounts of collagen are present, evidences of inflammatory reaction can be detected. Whether this is to be interpreted as meaning that large amounts of collagen are necessary for the production of destructive and inflammatory changes, or whether these areas showing reaction are the seat of bacterial action, it is difficult to say. A striking fact, however, is the absence of marked necrosis and inflammation wherever small amount of collagen is present.

This case demonstrates conclusively that collagen when injected into the pelvis of the kidney for purposes of pyelography can enter the parenchyma where it may be demonstrated not only in the collecting tubule but also in the stroma, connective tissue cells and glomeruli, invading the cortex as far as the capsule of the kidney.

**CASE.** Male 35 years of age admitted to the genitourinary service of the Mount Sinai Hospital on February 9, 1934 for prostatic abscess and mass in the region of the right kidney. For more than 3 years the patient had had attacks of pain in the right lumbar region shooting up into the chest and back. Some of these are attended by fever others are so mild and ticklish that positive



Fig. 2. Collagen in Bowman's capsule.

diagnosis had not been arrived at up to the present time. On admission to the hospital, the patient, as noted upon deep pressure in the right hypochondrium there is marked rigidity of the right rectus muscle in this region and in the 2nd quadrant very distinct, enlarged renal shadow could be seen. The tentative diagnosis as hydronephrosis with marked perinephal inflammation, as indicated by the intense rigidity of the right rectus muscle.

Cystoscopic examination February 20th showed that the function of the right kidney was at least temporarily impaired, the urine showing few clumps of white blood cells.

On February 24th catheter is introduced into the pelvis of the right kidney and about 30 cc. of 50 percent argyrol solution are very slowly and carefully injected by an assistant, pyelogram being taken immediately afterwards. The radiogram (Fig. 3) showed considerably enlarged renal pelvis with the several changes of the renal type of hydronephrosis.

A very few hours after the injection of argyrol the patient complained of severe pain in the right lumbar region the temperature rose to 101 and there is considerable distress for only four hours. The temperature gradually fell so that on the third day according to the argyrol report from the patient as almost comfortable. Another X-ray taken on the 5th of February, four days after the argyrol injection, to determine whether the pelvis is completely empty of its argyrol contents, showed no visible argyrol in the pyelogram.

On the 4th of March I explored the right kidney through the usual oblique lumbar incision and found an enormous kidney in nearly adhesion with the evidence of perinephritic inflammatory process of long duration. The size of the enormous size of the kidney and for fear that the left kidney might not be adequate (or possibly as of the reliable type) it was deemed wise to explore further before deciding upon nephrectomy.

Upon opening the capsule of the kidney and exposing the cortex, the parenchyma was found intensely congested presenting on its surface small areas of greenish black discoloration. The small pyramids removed for microscopic examination, both of these being taken through parenchyma, was that was evidently the seat of necrosis and blackish discoloration.

A rubber tube was inserted into the pelvis, and the kidney drained. The further course was uneventful. The kidney became smaller, renal fistula remaining for five weeks, spontaneously closing. The patient left the hospital free from renal symptoms.

**Microscopic examination.** In this case sections were only made from the two small pieces of tissue taken from the cortex of the kidney at the time of the nephrotomy. On gross examination these appear to be made up of congested, bluish black, somewhat edematous renal tissue, in which there are streaks of necrosis, together with black pigmentation.

Histological examination shows, here also, the presence of two lesions—first, the lesions belonging to the hydro-nephrotic condition of the kidney, and second, the changes associated with the presence of argyrol.

The chronic changes in the renal tissue are somewhat more marked in this case than in the last, there being a more extensive involvement of the tubules, more dilatation of these, more atrophy, and more interstitial and parenchymatous nephritis.

The important lesion, and that apparently associated with the presence of argyrol in the tissue is extensive necrosis giving the picture of an anemic infarct, in which diffuse infiltration with argyrol is a feature. In these infarcted or necrotic areas only the shadows of glomeruli, convoluted tubules, and interstitial tissue can be discerned, but their structure is sufficiently evident to enable one to discern clearly their relation to the argyrol deposits. Although argyrol cannot be detected in all parts of the areas of necrosis, it is to be found in sufficiently large quantities to arouse the suspicion that the infarction or necrosis is directly due to the drug.

For the most part, the drug is present in the form of black pigment in the lumina of the tubules, in the glomeruli, in the necrotic interstitial tissue, and in the areas of exudate bordering on the zones of necrosis. In other places argyrol seems to be present in the form of brown coloring matter that impregnates the coagulated cells of the tubules. Here a sort of ringlike brownish mass represents the remains of the tubules.

The most striking lesion is found in those areas in which the interstitial tissue is diffusely infiltrated with the drug, the stroma turning diffusely as golden brown network surrounding the urinary tubules. In such areas there can be no doubt as to the nature of the discoloration.

It is evident, therefore, that argyrol of a potent strength, when injected to the pelvis of the kidney, may find its way into the parenchyma



Fig. 4. Collagen in collecting tubules and in cells in inflamed stroma.

where it may diffusely infiltrate the interstitial tissue with a golden brown stain, or where it may become deposited in the form of black or brownish black pigment in the tubules, in the glomeruli or in the stroma.

Although the infiltration of the renal parenchyma by the silver salts was apparently not dangerous to life in either case, and although the appearance of the kidney in the first case and the clinical course in the second speak for the possibility of recovery from the necrotic lesions, nevertheless the circumstance is sufficiently grave to warrant careful analysis, with a view to avoiding if possible its occurrence in the future. The following questions seem worthy of consideration.

1. Is the infiltration of the parenchyma with silver salts influenced by the technique employed?

2. How do the silver salts enter the parenchyma?

3. How are the abscesses brought about?

4. Why do collagen and argyrol cause necrosis in living tissue which under ordinary circumstances, does not seem to be seriously influenced by these drugs?

As for the first query, it seems scarcely probable that the entrance of the silver salt into the tissue is influenced by the technique employed. It is true that in both instances the fluid was injected by means of a syringe and not by the gravity method. However, the injection was so carefully and slowly made, and the amount used in the first case, so small (1 ccm.) that the initial force of injection could hardly be held responsible.

A study of the infiltrated areas brings to light



Fig. 3. Pyelogram of kidney in Case 1 showing renal type of hydronephrosis.

the fact that although the interstitial tissues also harbor the silver salts far up in the cortex, most of it must make its way upward through the urinary tubules. In Fig. 4 the straight collecting tubules are seen filled with collargol and it may be assumed that many more of these collecting tubules had previously contained the salt. Many of these can be directly traced into the necrotic and purulent areas containing fairly large amounts of black substance.

The cause of the development of the abscesses encountered, particularly in the first case is not easily explained for it is not certain as to whether small inflammatory foci were not already present before the injection.

In the second case the inflammatory areas bear a more definite relation to the areas of necrosis and argyrol penetration so that little doubt exists as to their causation. It is more than likely that a stage of primary necrosis precedes the abscess formation. The development of abscesses depends, it seems to me on secondary invasion with organisms possibly carried in from the pelvis by the ascending silver salt. The assumption that the areas of necrosis can remain aseptic and bacteria-free, is strongly supported by the fact that the kidney of Case 2 apparently healed out

completely although extensive necrosis was present.

Finally as to the reason for necrosis, it would appear more than likely that several factors in addition to the presence of the silver salts are responsible. Thus in both cases there was marked impairment to the outflow of the silver salt, so that its retention was favored. In the first case by reason of an ureteral stricture. In the second case by the very same cause that had produced the hydronephrosis—an obstruction at the ureteropelvic junction (Fig. 5). Added to this factor we may assume that late contractions of the renal pelvis—as they are manifested in the renal colics following the pyelography—may be instrumental in furthering the ascent of argyrol or collargol into the parenchyma when its descent into the bladder is prevented. Given the retention of the salts and their entrance into the renal tissues, an additional circumstance must be sought to explain the necrosis. A not unimportant predisposing factor and one which is demonstrable in many sections, is hemorrhage. That the penetration of silver salts into the tubules and interstitial tissues may be accompanied by hemorrhagic extravasation, may be accepted without hesitation.

May not another reason for the necrosis be found in the lowered resistance of an inflamed or congested renal parenchyma? In Case the extensive perirenal inflammation and the intense stasis due to the ureteral obstruction doubtless contributed toward the production of a congested parenchyma and in Case 2 similar conditions were likely.

#### CONCLUSIONS

Collargol or argyrol when injected into the renal pelvis for purposes of pyelography may penetrate into the renal parenchyma as far as the surface of the kidney.

Extensive necrosis and suppuration foci may be the consequence. Aseptic foci of necrosis may heal, all renal symptoms disappearing.

Interference with the outflow of the silver salt inflammation or congestion of the renal parenchyma, are predisposing factors in the production of the necrosis.

Our endeavors should be directed toward evolving methods for the prevention of this untoward complication. Thorough evacuation of the renal pelvis through the ureteral catheter aided by irrigations with saline solution or boric acid whenever spontaneous drainage does not occur may be regarded as precautionary measures that should be employed in every case.

## IMMEDIATE BONE TRANSPLANTATION IN COMPOUND COMMINUTED FRACTURE OF TIBIA AND FIBULA

## ONE OF THE FRAGMENTS USED FOR A TRANSPLANT

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THIS is the era of transplantation in surgery. Fascia and other tissues and numerous foreign substances have been transplanted for various purposes and no one can foretell what the final possibilities of transplantation really are. The case which I report herewith has, I believe, opened up another field for transplantation and, so far as I can learn, there is no other similar case on record. It is for that reason that I report it. Furthermore the outcome was such an extraordinarily gratifying one that I believe it will surely serve as a means of encouraging others to try the same procedure in similar cases, thereby saving limbs.

We must confess that in many of these cases an amputation is performed, and perhaps at the time that might seem to be the best procedure; nevertheless, there can be no doubt that a considerable proportion of these cases a transplantation such as was carried out in my case is a perfectly feasible procedure and one which should at least be considered before an amputation is done. Furthermore it not only saved the patient's foot in our case, but gave her a useful foot. The case was as follows:

Female, age fifty-nine, housekeeper, married, never had any serious illness, as brought to the hospital because of broken ankle, September 4th. While crossing the street just after lighting from street car the patient was struck by an automobile truck thrown to the ground and one wheel passed over her left leg just above the ankle. She was immediately taken to the hospital and examined by Dr. Frost, who referred the patient to me later. He found that she had compound comminuted fracture of the left tibia and fibula about two inches above the ankle joint, with several spicula of bone protruding through the skin. There were also several contusions on the left side of the head and shoulder and hip.

The wound and considerable area around it were antiseptically painted thoroughly with tincture of iodine and dressed with sterile gauze. The leg was placed in an ordinary box splint, fearing the possibility of tetanus infection, fifteen hundred units of antitetanic serum were administered hypodermically.

On the following morning roentgenograms were made of the leg. The anteroposterior view showed apparently normal ankle joint, that is, the articular surfaces of the tibia, fibula and astragalus are normal and in normal relationship to each other. The fibula, as fractured about two inches above the tip of the malleolus. The upper fragment was overriding the lower fragment for distance of about an inch. The tibia was comminuted about

two and one half inches above its lower articular surface for distance of about five inches. The bone as partially splintered and lateral view of the ankle showed that the fragments were in malposition; the shaft of the bone as well as its ends (1 and 2).

I saw the patient for the first time on September 7th. After examining the roentgenograms very carefully I came to the conclusion that it would be worth while to try to reduce the fracture admitting, however, that it might be necessary to perform a more extensive operation. The patient, as anesthetized and the entire foot and leg up to the knee were painted with iodine. An incision was made on the outer surface of the leg just to the inner side of the crest of the tibia, connecting the two openings from which fragments of bone had been protruding. The skin edges were briefly crushed. There were very carefully trimmed off so as to give not only smooth surface for subsequent approximation, but also to remove any infected material which might have been growing into these skin surfaces at the time of the accident. Two protruding fragments of bone were lifted out of the wound with tenaculum and were found to be unattached and free of periosteum.

Further examination of the deeper layers of the wound revealed many small fragments of bone lying free in the tissue and apparently about any periodical covering. All of these fragments were removed. One fragment, which measured five and one half inches in length and about the thickness of an ordinary sized man's little finger, as placed in sterile salt solution to be put to some use later, because during the course of the operation this fact had occurred to me that I might use some of this bone for transplantation purposes, because about five inches of the shaft of the tibia had been crushed and if the ends of the two fragments were brought together the leg could be just that much shorter; therefore, when I removed this large fragment I thought of the use to which it might be put. It was sufficiently long to span the gap between the two fragments.

All the loose bone was removed from the wound. Bleeding points were looked for but none were found. The anterior tibial artery and vein had escaped being injured.

The large fragment of bone which had been placed in salt solution immediately on its removal was now carefully trimmed so that all the jagged edges were smooth and it was placed in the gap between the two fragments, each end resting securely in the medullary canal of the fragment. The lower end was quite firm but not so the upper. In order to give additional support to the upper end a double loop of No. 10 chromic catgut was thrown around the fragment of the tibia and the transplant and likewise one loop around the lower fragment and the transplant.

This gave me good and secure fixation of the transplant, both as said above, as not covered by periosteum. Nothing as done with the fibula. The fragments are in good apposition and we felt that it was safe to leave well enough alone, because of the extensive injury of the tibia and because we realized that we could not state positively whether all the infectious material had been removed from

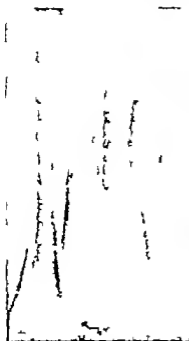


Fig. 1



Fig. 2

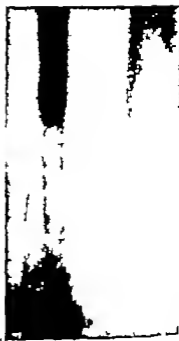


Fig. 3

Fig. 1. Composite comminuted fracture of the tibia and fibula in driving boot five inches of the shaft of the bone. The fibula fragments are in contact but on evidence. The upper shaft fragment of the tibia is displaced upward and the ankle joint appears to be normal.

Fig. 2. Lateral view showing malposition of the fragments and also the overriding of the upper fibula fragment.

There is a long thin specimen of bone protruding upward from the lower fibula fragment.

Fig. 3. Rontgenograms made the day after the operation. The transplant is driven down into the lower fragment and is little more than contacted with the upper fragment, contact being maintained by means of a loop of catgut thread around the shaft and transplant.

the wound although every precaution had been taken to do so. The entire procedure is as the nature of an experiment which felt as justified when the case was considered in its various aspects.

The soft tissues were then allowed to fall together and the skin and fascia were sutured with absorbent gut although the edges of the wound could not be brought together on account of the great loss of tissue. The cavity filled itself quite naturally with blood clot and it proved to be an excellent filling material. In order to prevent shortening of the leg, which might be caused by the contraction of the tendo Achillis, this was divided transversely and subcutaneously. This left the foot free from all traction from above.

Here then a human transplant takes right from the same bone into which it was transplanted. The transplant was free of periosteum and was not absolutely sure of its support but we all were that if the experiment proved failure we could make another transplantation later taking bone from the crest of the other tibia or an amputation could be done if because necessary (Fig. 4).

The wound was dressed with dry sterile gauze and posterior plaster of Paris was applied extending from the toes to well above the knee. The foot being held at right angles to the leg and further adjusted in strapping.

separate the fibula fragments and giving additional support to the transplant.

The subsequent course of the case was as far as the operation is concerned rather uneventful. The patient's temperature never rose above one hundred and the highest pulse so many are—rather gratifying course in case of this kind occurring in a patient fifty-nine years of age. The first discharge of serum from the wound within three weeks the entire wound had healed by primary union. Unfortunately for the patient she developed pyrexia, congestion of the lower lobes of the lung at this time from which however she made good recovery. She left the hospital at the end of nine weeks still wearing plaster of Paris cast on the ankle.

Rontgenograms were made about nine weeks after the operation and we could not feel other wise than pleased with the progress of the case. The leg and foot were plumb, the fibular fragment had united firmly, the transplant was doing its work and union had already taken place between the ends of the transplant and the tibia (Compare Fig. 1 and 3). There was a considerable



Fig. 4

Fig. 5

Fig. 6

Fig. 4. Lateral view showing osteogenesis progressing between tibia fragments and showing good approximation and alignment of the fibula fragments.

Fig. 5. Nine weeks after the operation. The osteoprocesses had progressed to considerable degree. The lower end of the transplant is firmly united with the lower tibia fragment and the upper end is also becoming osseously united to the tibia fragment. Comparing with Fig. 4 this is shown very well. New bone has bridged across the

gap from the transplant to the tibia on the inner side. The ankle joint is normal although there is a slight adduction of the external malleolus.

Fig. 6. Fifteen weeks after the operation. The bony union is firm and there is considerable deposit of bone on the outer surface of the transplant reaching over into the tibia. The strip of peroneum attached to the tibia above and lying free in the wound might be something to do with this bone deposit.

able deposit of bone extending from the outer surface of the transplant at about a middle up onto the tibia, and when it is remembered that young bone or osteoid tissue does not give a shadow with the roentgen ray it will be appreciated that there was much more bone in the process of forming than was shown in this roentgenogram. The lower end of the transplant had become so thoroughly united with the lower tibia fragment that its outlines were lost. A lateral view (Fig. 4) shows that there is no deformity of the ankle or leg and the alignment of the bone is perfect. By comparing this picture with Fig. 3 the progress made by the new bone formation is apparent.

A second set of roentgenograms was made about eighteen weeks after the operation (Fig. 6). The bones are now solid. The union between the tibia and the transplant is firm and complete

and was still progressing. Seven months after the operation regeneration of bone was still taking place. The transplant is disappearing by absorption and new bone is taking its place (Fig. 8).

There are several points in connection with this case we wish to emphasize. First, the nature of the fracture a compound comminuted fracture occurring under circumstances which would naturally lead one to infer that an infection must have taken place. Second, the age of the patient. She was no longer a young woman but was of an age at which regeneration of tissue does not progress rapidly as a rule nor is the resiliency of the tissues high. Third, we made use of a transplant which was removed from the wound and which was not known to be septic in other words, in which there lurked the possibility of an infection. Fourth the transplant did not have



FIG. 7



FIG. 8

Fig. 7. Lateral view showing normal anatomic relationship between tibia and metatarsals and perfectly straight leg. Note the bridge of bone between the fibula fragments (1).

Fig. 8. Six years' time seven months after the operation. The identity of the transplant is being lost, although its outlines are still to be detected. New bone is still forming on the inner side of the tibia. The union is solid.

5) periosteum on it. Fifth the comparatively rapid regeneration of the bone union having taken place nine weeks after the operation the union being well-nigh perfect eighteen weeks after the operation, the new bone being of the same thickness as the old bone. Sixth, while this patient suffered pulmonary infection shortly after the operation, metastasis of the infective products into the transplant or around did not take place. Seventh, we cannot fail to mention this connection that while the transplant was devoid of periosteum the bed in which it was placed may have been the periosteal bed of that portion of the shaft of the tibia which was shattered by the trauma. Still every careful examination of the roentgenograms made after the operation failed to show anything which might be construed as periosteum, and therefore we feel that the osteogenesis took place entirely from the tibia fragments, passing from one to the other through the haeretic anastomosis of the transplant.



Fig. 9. Lateral view seven months after the operation.

It is not our purpose at this time to discuss the merits of the use from the point of view of merely wish to report the case to encourage others to carry out similar procedures.

## THE USES OF AN ARM-BOARD IN SURGERY

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TO obviate the necessity of having a special assistant to hold the arm in operations for cancer of the breast I hit upon the idea of using an arm-board, such as is employed in our dissecting rooms. This simple device has been so useful that I think it is worthy of attention.

The board which I employ is shown in photograph, Fig. 1. It is made of soft wood five eighths of an inch thick, measures four feet in length, is five and one-half inches wide at one end and three and one-half at the other. The broad end is beveled so as to form a long thin wedge while the notches at the narrow end are for fixing the bandage to keep the arm in position.

The beveled end of the board is pushed under the sheet on which the patient lies, and between it and the top of the table, so as to project away from the side of the latter for any convenient distance. A folded towel is laid on the board and the arm fixed by a turn or two of bandage, care being taken not to apply it too tightly.

With the arm on the board the position of the latter can be readily altered as often as may be necessary during the course of an operation and without disturbing the towels, etc.

Fig. 2 shows the arm arranged as for excision of the breast. The sterilized towel is fixed over the arm with metal trouser clips such as are used by cyclists. They surround the arm and get a hold on the edges of the board in addition. The simple anæsthetic screen which I described in the British Medical Journal is shown in position, the towels being fixed to it by a couple of ordinary tie clips.

The whole arrangement is exceedingly simple and satisfactory and has the great virtue that it can be applied to any form of table and at any part of the table and can be altered by the sur-



Fig. 1. The Arm Board.

Fig. 2. The board supporting the arm in amputation of the breast.

Fig. 3. The board supporting the arm for an operation on the finger.

geon during the course of the operation without trouble.

The third photograph shows the board arranged for an operation on one of the fingers. Though useful for many purposes, it is especially convenient for any interference in the neighborhood of the axilla. Having now used the arm-board for about three years, I have come to look upon it as an essential part of our armamentarium and can recommend it with the greatest confidence as to its utility.





Fig. 1. Case 1. Showing the original injury both the bullet and piece of bone in the brain substance. Coal of iron marks the point of entrance.

It was very interesting to find that this operation the amount of new bony tissue present and evidently coming from the bone itself since the periosteum had been previously removed, nor was there any sign of its bridging across, the edges being just as left at the previous operation.

CASE 1. B. is that of a young man seventeen years of age who gave the following history: Complaint stiffness of right leg and difficulty in walking. Family history and past history negative. Present illness: Seven years ago the patient was struck on the head (left parietal bone) with a stone.

The blow knocked him down, but he got up immediately and walked to the house—distance of thirty to forty yards. The patient stayed in bed for one week and then began to recover.

About one week after the injury the wound began to bleed profusely and continued to do so frequently during the next three months so that he was constantly kept very weak and pale.

The first solid food which he took three months after the accident caused him a series of convulsions over a period of about four hours. He was operated upon and part of the parietal bone removed and because he was of the egg-shaped type, opened and drained. From that time he began to improve and regain his strength. Four years after the accident his friends noticed he was limping, his right leg shifted out and described as small as the other. This gradually became more noticeable, the toes of his right foot began to draw down and the entire foot became deformed plantar. He had three crutches. After several months his foot straightened on again and he discarded his crutches.

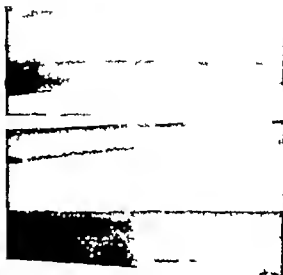


Fig. 2. Case 2. Showing front and side view of tibia from which the graft was taken. Fifteen days after operation.

About one year ago his foot began drawing down and gradually stiffened but he rapidly improved during the last four or six months. There is no subjective disturbance of sensation in his foot or leg. He has not had convulsions during the last six and one half years nor headache. Occasionally upon exertion he feels as though he were tripping and can feel the blood pulsating near the old scar on his head. A ray showed depressed fracture.



Fig. 3. Case 2. Showing graft in position. There is definite new growth of bone between the graft and the skull at the points of contact. No evidence of new growth at the end of the graft or at site of the overlapped periosteum. Fifteen days after operation.

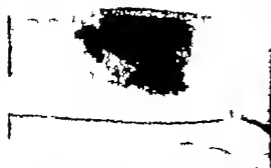


Fig. 4. Case 2. Nine months after operation showing line of healed fracture (upward and back angle toward fibula); evidence of the screw holes used in the steel plates; external amount of callus; 1 of the removed segments of bone completely healed and yet the periosteum as reason of it and for distance of 10 in around the graft. Second operation it applied the plate treatment of the fracture) showed the presence of new bone but the edge of the periosteum is left at the first operation.

**Operation.** In each case the depressions were opened up and all depressed bone removed, care being exerted to remove all sequestra pressing against the brain substance and smooth the under surface of the cranium. Exploration failed to show the presence or suggestion of a tumor. Scar tissue and adhesions were freed as well as possible.



Fig. 5. Case 2. Nine months after operation. The position in this picture is slightly faulty; that the graft is not directly in line such that only one edge is shown. However it shows the graft in position and anchored to the cranium and the defect in the lat or back of the skull. No evidence of bone growth anywhere, nor is there any suggestion here that the periosteum has played any part in the regeneration of bone.



Fig. 6. Case 3. Showing the graft in position and the presence of new growth of bone between the graft and the cranium, but no evidence of bone being thrown down by the overlapped periosteum. Fourteen days after operation.

A rectangular piece of bone large enough to cover the cranial defect was in each case taken from the flat surface of the tibia along with the periosteum covering and slightly larger than the graft and placed over the defect and anchored in position by sewing the periosteum of the graft to that of the skull with chromic catgut. The bone was full thickness and included a little marrow under the surface. Scalp closed snugly over this with black silk sutures.

In each case radiographs were taken about 10 weeks after the operation and show apparently a growth of bone between the under surface of the graft and the skull and no suggestion of new bone being thrown down by the periosteum. The periosteum was taken with the graft so as to anchor it in position.

The periosteum was removed from the tibia in each case so that here we shall see whether it is necessary for regeneration or if the bone itself and alone will bridge over the gap, and if so, if there will be any overgrowth because of the absence of the periosteum and its function as limiting membrane.

#### REPORT

**Case 1.** C. F. S., age 36. Complaint: convulsions. History: and past history, negative. Present illness: Throat trouble as a goiter, as struck over the left parietal area by falling limb subsequently fractured skull and portion of his brain escaped. He was unconscious for 10 days in hospital and for several days was unable to speak.

and for several months speech was halting and slow. He was generally incapacitated for mental work for eight or ten years. During the past fifteen years he has periods of obsessions—a delusion of committing murder and occasional mania, but he feared he could commit such thoughts he has never done so. He has a fair memory but has been poor ever since injury.

1. November 9, 1913 (eight months ago) he had a convulsion of the right side of the body. After he had gone to bed suddenly he awoke in the peculiar sense upon his head and with things black before his eyes though there is light in the room. He is unable to speak and has no motion of head or arms to the right. After a few minutes he staggered across the room and then lost consciousness for about fifteen minutes. Following this for several weeks he was partially paralyzed and the legs to regain motion so that he was able to walk after a few more weeks. In February 9, 1914 (six months ago) he had a similar attack though paralysis or muscular weakness was not so marked. The third attack, six weeks ago and more than the previous, frequently during the last six or eight months he has been unable to open his right eye.

Physical examination revealed scars following the temporal suture on the left side and a depression of the bone beneath. The left half of the cranium seems considerably flatter than the right. The extra-ocular muscles good. There is some break in con. optic. No diagnosis no exophthalmos. Deep reflex somewhat exaggerated on right side. Oppenheim and Babinski reflexes absent. No ankle clonus. Other examination negative.

X-ray showed a jagged fracture of left parietal region with depressions in several points and breaks of cranial tissue just beneath the fracture. There is also depression in the frontal bone.

Operation: As practically the same as in the preceding cases except that about two ounces of clear fluid was evacuated from a pocket just beneath the depression. In following the contour of the skull was necessary to employ a rasp. It explains one being about one by one and one half inches over the frontal opening and the other one by one and one half inches over the temporo-frontal opening.

Over eight months have elapsed since the operation and the patients remain very much

improved. Case 1 is practically cured. Case 2 very much improved, having an occasional convulsion, usually associated with constipation. With close attention to his bowels he has not had one for over three months. His mentality is as good as several years ago and he is back at his work, a clerical position. Case 4 has gained twenty pounds in weight and is free from symptoms except an occasional convulsion. Six in all since operation. Case 3 has moved from this territory and I am unable to get a reply to my letters.

#### CONCLUSIONS

The total graft is a means of covering cranial defects made for whatever cause that it lessens the likelihood of spicules of bone growing downward as when the skull is left open.

That the regeneration of bone takes place independently of the periosteum as illustrated by the growth of bone between the graft and the skull and in the tibia from which it had been removed.

3. The periosteum is an excellent means for anchoring a graft in place.

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## PULMONARY ABSCESS

B. A. HOWARD PIRIE, M. D. MONTREAL, CANADA

DURING the past year I have had to deal with five cases illustrating the value of X-ray in the diagnosis and treatment of abscess in the lung. Three of these cases were shown by X-rays to be suitable for operation. Of the remaining two, one was also suitable, but this case was complicated by the presence of tubercle bacilli in the sputum. The fifth case presented the clinical signs of abscess, but X-rays demonstrated that operation was not

indicated, as no localized collection of pus was present, but rather a large dense area corresponding to a gangrenous lung. In the latter case operation was followed by death. In the first three cases recovery followed operation, with gain in weight in each case. The case of bacilli accompanied by extensive tuberculosis was not treated.

A plat of the chest made with the patient in the horizontal position is useless for the diagnosis

parametritis posterior etc. are not rare. The conservative treatment of such chronic inflammation" with laths, etc. amount to positive negligence.

The history of a previous gonorrhoea of the husband too easily distort the view of the physician. I venture to say that a man without symptom even when urethral shield are still present can no longer produce pyosalpinges or severe inflammations of the adnexa. I must further maintain according to my experience that the transference of acute gonorrhoea to the female from a symptomless old gonorrhoea of the male is exceedingly rare. Dermoids in childhood are occasionally recognized too late and therefore neglected. It is too easy to look for the ghost of infection while the strange intruder (the tumor growing from the ovary or uterus) is overlooked.

*Diagnosis.* In patient with myomata the onset of fever would always cause one to think first of a necrosis or abscessing of the tumor. The X-ray is of no avail here. One should not forget that pyosalpinges can occur with a myomatous uterus. Observation and experience must tell the surgeon whether he can treat them conservatively or whether he must operate upon the putules resulting from these tumors. Adnexal suppurations arise from hard calcareous tumors just as suppurations in the gall bladder or kidney pelvis is caused by prolonged pressure of stones.

Only those retroflexions which are free from adhesions and correctly replaceable may be treated by pessary. The pressure of the pessary against the uterus lying between the folds of the pouch of Douglas had first to pain which denotes the beginning of adhesion. Whether or not a uterus is free from adhesions cannot with certainty be determined. The uterus which is not replaceable without narcosis is frequently free from adhesions while the replaceable and movable one may show long membranes which are stretched from the posterior wall and appendage to the rectum. Any operation for retroflexion which does not permit of a full view of the organ and of the deepest point of the pouch of Douglas from this fact alone is

always of questionable utility. Therefore, the Alexander operation is a lottery with many blanks. The freeing of the smallest adhesion is of more importance than this or that "modification" for the fixation of the uterus. Even small myomata which can be mistaken for the retroversion, or may be responsible for it, may without such clear view be entirely overlooked.

We have now come to the treatment of adhesion and I shall complete what has not already been discussed in the foregoing. We have to consider the timely removal of growth and all things obstructing from operation in recent inflammatory processes and the more frequent use of the paracentesis of the anterior fornix and the pouch of Douglas. The most important negative treatment namely douching tampons heat bath etc. are only mentioned where these are helpful, the parts should be left alone. Only the chronic painful adhesion of the organs shall concern us.

A simultaneous healing and restoration of function depend upon the extent of the adhesions. Thus we see in cases of artificial adhesion which we attempt to produce in retroflexion operation varying in all stages from a relaxation of the artificial peritoneal attachment to stretching into long band or even completely breaking. Adhesions may atrophy tear apart and from the movements of the abdominal content be worn out by friction. A healing factor is the advent of pregnancy. That such may happen in cases of adhesion is certain and pregnancy can also be carried to full term. I have seen in a cesarian section where no abdominal operation has been done before a uterus covered entirely over with adhesions twenty to thirty cm long. Stretching leads to the disappearance of the adhesions or at least to the pain which they produce. Even tubal pregnancy may favorably influence an old adhesion. Quite often we meet with the following history: inflammatory abdominal disease adhesions, sterility of long duration finally conception tubal pregnancy necessitating operation, thereby freeing of adhesions, and now soon afterward intra uterine pregnancy with a living child.

cover. I saw him four and one-half months after the operation; he was in excellent health, and had no cough. Screen examination presented the appearance of normal chest.

**CASE.** A N., age 5, admitted under Dr. Hamilton, Royal Victoria Hospital, Montreal, February 9, 1914, suffering from cough and profuse foul smelling expectoration. Had pneumonia with empyema. t. 37. Appendicular abscess opened three months ago. For the last fifteen years he had had cough and expectoration, both ones during the last three months. For the last ten years he had been looked on as a case of tuberculosis of the lungs. Foul odor appeared in sputum two weeks ago, and has continued. Sputum now 6 ounces per 24 hours.

**Examination of chest.** Vocal fremitus in left infra-clavicular region, faint and absent in the other areas. Percussion, posteriorly left side dull. Auscultation. Decreased murmur in left infra-clavicular region with loud rales both moist and dry. Other areas of chest silent. Skiagraphs showed level of fluid in the abscess. The level kept horizontal as the patient moved from erect to lying on side (see radiographs). Fourteen days later operation failed to localize the abscess, although an aspirating needle, as inserted into the lung in various directions, but not smelled by the surgeon. On February 26th three days later foul smelling pus escaped by the incision. The temperature fell to normal and the patient continued to improve. He gained seven and one-half pounds in

about month. He went home and the discharge lessened, and the expectoration increased. The former remained foul smelling, but not the latter. On March 28th, X rays showed abscess to be empty. On May 5th he had gained 3 pounds, coughed only on rising, spat once or twice a day. Wound not yet quite healed.

#### CONCLUSIONS

From experience in these cases one gains the following information:

1. Abscess in the lung partly filled with pus and partly with gas can be diagnosed by X rays.

2. A negative made with the patient lying prone is of no value.

3. A negative made with the patient erect will not show the condition unless the horizontal ray from the X-ray tube has passed through the horizontal upper border of the fluid.

4. It is essential to make a fluoroscopic screen examination with the patient erect and to move the X-ray tube from the level of the upper part of the chest to the lowest part of the chest looking for the horizontal line. It may even be neces-



Fig. 1. Abscess in lung patient inclined. Fig. 2. perpendicular.

of abscess. He must be erect and the horizontal ray must pass through the upper level of the pus in the abscess cavity. The upper level of the pus gives a horizontal line which is pathognomonic when it is confirmed by a plate made with the patient lying on his side. In this position the fluid remains horizontal but is parallel with the spine whereas when the plate is made with the patient erect the shadow of the horizontal line is at right angles to the spine. The horizontal ray must be used in each case passing through the upper level of the fluid. (See radiographs.)

The following is a short account of two cases of pulmonary abscess illustrating the value of X rays in diagnosing and localizing abscess.

**CASE II.** P. M., 49, under Dr. Hamilton, Royal Victoria Hospital, Montreal, admitted December 4, 1913, complaining of cough, foul sputum and bloody expectoration with pain in right ribs. Teeth extruded twelve weeks ago. Pain in right ribs followed twelve days after extraction accompanied by cough followed in few days by foul smelling expectoration and in six days before admission by fever, fast pulse and night sweats.

**Physical signs on admission.** Over right upper lobe, increased vocal fremitus and vocal resonance, dullness on percussion, increased respiratory murmur with prolonged expiration, coarse crackles, scattered focal wheezing with free expectorated blood. No tubercle bacilli. Other parts of chest normal. Temperature hectic from normal to 101.4 for three days, with spikes twenty then he expectorated

large clots (half two cups) ery and foul. Temperature normal in 1 day. Transferred for operation. X-ray plate made lying down showed no definite evidence of abscess. The appearance was like that of acute localized tuberculosis. On standing the patient up, horizontal line seen in the upper right lobe with slight elevation, and clots are below the horizontal line. This line remains horizontal when the patient is on his affected side. Stereoscopic plates were made and the presence of an abscess filled with fluid and filled with gas above the fluid was diagnosed. The depth of the abscess was shown but not very clearly by the stereoscope.

**Operation.** An incision as near to the axilla rib removed to allow free access lung exposed. A large trocar thrust into the lung but failed to strike pus. This was repeated four times and on each occasion the surgeon (Dr. Watson) noted the trocar after the puncture. After the fifth puncture no pus was got, but the trocar had forced well. A large opening was made along the line of the last puncture and the abscess was found and drained. Patient made an uneventful recovery.



Fig. Abscess in lung patient standing erect

# BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS IN SURGERY

By N. G. SEILIC, M. D. SAN LOUIS, MISSOURI

THE surgeon Billroth once put it his friend Professor Lueble letter that was a soul cry of futile protest describing the weary dragging details in the daily life of a active surgeon, and interpolating every now and then the phrase, *denk daran*. One of the annoyances complained of by Billroth was the necessity of wading through masses of medical literature — necessity which he met bravely but nevertheless in its manifold part of *denk daran*. Nor is Billroth the only one to propose the hopeless "by then?" Even the book reviewer who should have before his mind's eye constantly the determination to read the books large part of every author's pride and hope and enthusiasm even such content sighs wearily *denk daran*. Surely it is true that if scientific books are written only answer to a specific need for them there would be many less books published, and consequently much larger proportion of worthy product. The temptations of authorship are great but by just as certain token the task of accomplishment is greater.

Let us for example spirit of honest inquiry not just how much the books of the month furnish evidence in some form or other justifying their birth. And let us start off with Ashhurst volume on the Principles and Practice of Surgery. Only a few months ago commenting on the new work by Bryan, on Principles of Surgery, pointed out the superfluity of such volumes. There are so many books on Principles that new one must justify itself on some special ground such as more logical development of data particularly clear incisive didactic style or a strong personal not based on extensive and well utilized experience. It is difficult to find any one of these characteristics in Ashhurst book. The arrangement of the chapters is just about as usual as respect to find them — Inflammation Tumors Surgical Technique I junction Amputations etc. There are in all twenty nine chapters divided into three groups respectively devoted to General Surgery Systemic Surgery and Regional Surgery. It is open to question whether such a classification as this will not confuse the average medical student but even so it certainly is almost impossible to do justice to such classification in volume even of thousand

pages particularly difficult when almost three hundred of the thousand pages are devoted to bone and joint diseases.

As regards the detailed material contained in the volume one must say candidly that it is a poor formal standard. There are very few if any serious misstatements as far as subject heads themselves are concerned but the broad scope of the work renders it painfully necessary to abridge to the limit. The important subject of fat embolism, for example is dismissed in a few lines, with the more or less misleading statement that the symptoms are the same as those of ordinary pulmonary embolism. Under the head of differential diagnosis between shock and hemorrhage, the laconic statement is made that this differentiation is frequently impossible — and there the matter is dropped. Under transfusion, the author outlines the rather complicated method of Crile and mentions none of the other direct or indirect methods and this in spite of the fact that Crile himself now uses the Elberg cannula. Many cases. Under the head of peritonitis, not a word is said by way of correlating the important subject of physiology of the peritoneum with the pathology of peritonitis. Under the subject of hernia, he notes with disappointment that Ashley Cooper Ashhurst does not explain why direct inguinal herniae are usually bobonoceries. It was Ashley Cooper who furnished the first satisfactory explanation that I have been able to find in surgical literature. The question of cerebral compression is far from being settled yet for the purposes of clear exposition Ashhurst would probably have done better to repeat the very simple and satisfactory theory of Kocher which is now so generally accepted. A young man who has attempted to treat tumor pathology students will question the wisdom of Ashhurst's part of adopting Adams' classification it is difficult to see why the older and simpler even if less accurate, description of tumors was not followed. And finally may not take rather vigorous exception to Chapter II headed Diseases Resulting from Inflammation. This chapter discusses abscesses ulceration, fistulae, gangrene cellulitis erysipelas septicemia sapremia and pyrexia. The inference from the heading of the chapter is that these conditions are diseases that arise from inflammation, and that other diseases must necessarily have some other than inflammatory origin.

All these are merely points open to question.

SUBJECTS IN PRINCIPLES AND PRACTICE for Students and Practitioners. By Ashley Cooper Ashhurst. M. D. Philadelphia and New York: Lea, Febiger & Co.



Fig. 3. Abscess in lung patient lying horizontal with the abscess side down. and The surgeon failed to find this abscess and it burst through bronchus three days after the operation.

try to turn the patient from side to side to get the horizontal line shown exactly.

5. Having found the horizontal line the patient should be placed on the affected side, the hips being raised a little so as to get the spine horizontal. In anteroposterior screen examination should be made and one finds that the horizontal line of the fluid in the abscess is now parallel with the spine. The upper and lower level of the abscess are thus defined.

6. Stereoscopic view of an abscess do not appear very stereoscopic as neither the horizontal line nor the congested tissues round the

abscess lend themselves to stereoscopic work.

An attempt should be made to localize the gas above the abscess. A practical method is to place lead buttons in front of and behind the chest so that they are in line with the gas in the abscess. Then change the position of the tube and repeat the proceeding. Join by imaginary lines the positions of the first two lead buttons and of the second two. Where these imaginary lines meet fix the gas, and one gets sufficient idea of its depth to help the surgeon in his operation.

7. The surgeon should swell the trochar after each exploratory puncture.

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## THE CHOICE OF THE METHOD OF OPERATION IN THE TREATMENT OF GASTRIC AND DUODENAL ULCER

WITH A REVIEW OF MY EXPERIENCE ACCUMULATED IN THE PAST TEN YEARS<sup>1</sup>

BY PROFESSOR FRIEDRICH A VON EISELSBERG, VIENNA, AUSTRIA

IN spite of the progress made in the diagnostics of gastro intestinal diseases among which I place rontgen examination first, the choice of the method of operation for gastric ulcer and its complications can best be made at autopsy *in vivo* when the abdominal cavity is opened. It is most important that the operator should satisfy himself whether there exists an ulcer with an unhealed surface or a healed ulcer in fact a scar and whether the ulcer is situated at the pylorus or at a distance from it. When in possession of these facts he is in a position to decide which operation is to be recommended: gastro-enterostomy only, pyloric exclusion or as a last resort resection.

The operations for the acute and chronic conditions found in gastric ulcer are among the finest achievements in modern surgery. That the operation is a gratifying one and justly fills the surgeon with pride and satisfaction will be admitted by all who have witnessed the recovery of a patient who had been suffering from an acute perforation due to a gastric ulcer and who has been rescued from imminent peril, by laparotomy, irrigation of the peritoneal cavity and suture of the ulcer or again the restoration of a patient suffering from chronic pyloric stricture to perfect health, by gastro-enterostomy.

Gastro-enterostomy especially has come to be considered the operation most frequently attended with beneficial results, and to-day there is no operation so often done in the gastro-intestinal canal, excepting of course appendix resection. Where the operation can be performed it is now recognized as the universal method of treatment in all cases of ulcerated processes of the stomach. But the happy results of gastroenterostomy just now mentioned are not evident in all cases. In cases of persistent ulcer particularly its cures are not so numerous as in the cases of ulcers already healed. In cases where the ulceration is at a distance from the pylorus, the result of gastro-enterostomy is not so good as in cases where the ulceration is situated at the pylorus. Especially to my former pupil, Professor Clainmoot is due the credit of having discovered this. And finally one must always bear in mind that there may be a possibility of carcinoma in cases of tumor formation and obviously in these cases removal only is efficient, while a gastro-enterostomy would have at most a palliative value.

In consideration of the fact that gastro-enterostomy has become the usual operation in the treatment of gastric ulcers it behooves us to look very carefully into its merits. My deductions will be directed particularly to the



tinued but further details are unknown. Three patients died of tuberculosis of the lungs. One patient died of tumor of the suprarenal body. The cause of death in the remainder is unknown.

We see therefore, that of forty-one patients who died, most of them years after the operation of gastro-enterostomy thirteen—that is, nearly one third of the number—were victims of carcinoma, while six succumbed to the continued extension of the symptoms due to the ulcer.

In thirty-six cases of ulcerative processes in the stomach and duodenum unilateral pyloric exclusion was performed. In some instances this operation was done in the cases of still ulcerated and bleeding ulcers in the neighborhood of the pylorus and in some instances in cases of ulcers localized in the duodenum. Pyloric exclusion appears to be especially suitable in the latter case.

Table II summarizes the results of unilateral exclusion of the pylorus with gastro-enterostomy of the stomach and duodenum. Twelve operations were performed during 1913 but the interval after operation is too short to make a definite statement regarding results. However we may state that eleven patients made a complete recovery after the operation, and some of the cases were operated upon in the years 1905 and 1906. Under "Improved" we have even included cases complaining of insignificant symptoms and nearly all of them might justly be shown under the heading "cured." Of the four cases under "unrelieved" we note that in one the whole ulcer was extirpated to relieve the continued pain and cure followed. One patient still suffers from attacks of hemorrhage and two patients developed symptoms of peptic ulcers. Of three cases who died at a later date one case developed cancer of the stomach and two patients developed peptic ulcers.

#### SOME REMARKS ON PEPTIC ULCER

As the topic of the development of peptic ulcer again occurs at this point, I should like to go into the subject more in detail, especially as it seems to me that the facts concerning peptic ulcer of the jejunum are not so generally known as they should be.

TABLE II

#### UNILATERAL EXCLUSION OF THE PYLORUS WITH GASTRO-ENTEROSTOMY OF THE STOMACH AND DUODENUM

Total number of cases	36
Mortality after operation	
Subsequent Results	
Number of cases cured	
Patients lost sight of	5
Improved	4
Unrelieved	
On one patient second operation (resection of the whole ulcer) was successfully performed and the patient relieved entirely of symptoms.	
One patient suffers repeated attacks of hemorrhage.	
Two patients developed later symptoms of post-operative peptic ulcer but no further operation was performed.	
Death at later date	3
One patient died of carcinoma of stomach two developed post-operative peptic ulcer.	

Ten operations were performed during the four years as the interval is not sufficient for a definite statement as to results but up to the present are apparently cured.

As has already been pointed out by H. Braun of Göttingen, the discovery of this serious complication following gastro-enterostomy peptic ulcer appears to be caused by the continuous passage of the acid gastric juice into the small intestine, the duodenum causing erosion of the mucous membrane and giving rise to the growth of an ulcer. The lesion seems to occur in varying intensities. In the less severe cases symptoms in the form of simple pains such as an ulcer usually causes, may occur. In such cases as in all ulcerative processes, repair on the part of the organism may bring about a cure and in the cases of spontaneous cure, contraction and stricture of the gastro-enterostomy wound area seem to take place very easily. I cannot explain in any other way my observations in two instances, once in Königberg and once in Vienna, namely the *shrinking* of a gastro-enterostomy fistula, which I had made of normal size, to one third its size without any appreciable induration. Kehr described years ago the spontaneous closure of a gastro-enterostomy fistula and I presume the closure was caused by the healing of a peptic ulcer. For I believe that all these contractions are effected by the healing of a not very intensive peptic ulcer thereby closing the fistula.

In other cases the ulcer itself spreads, and with the serious and tragic issues of this condition we have to deal briefly to-day.

question of the value of gastro-enterostomy as compared with other operations for gastric ulcers, and I will define especially the conditions which indicate resection of the stomach.

While I review my cases of gastric ulcers I would direct your attention to Table I which summarizes the gastro-enterostomies for ulcerative processes performed in my clinic during the past ten years. My former pupil, Professor Clairmont, has helped me very considerably in collecting and arranging this great mass of material. He will shortly publish a large work dealing with our combined experiences in the operative treatment of gastric ulcer.

Now if we look at the Table I we shall see that out of a total of 334 gastro-enterostomies for gastric ulcer seventeen died after the operation. In twelve of these the ulcer was recent. Eight died from causes referable to the ulcer itself for instance hemorrhage from the ulcer progressive ulceration. Thus it will be seen that gastro-enterostomy in some cases not only did not stop the hemorrhage, but apparently induced it.

Now let us turn to the heading recoveries, which shows the results estimated after a considerable interval. Under cured we include those cases in which the patient is fully relieved from every symptom and inconvenience and is in proper condition to continue his calling. If any trouble or pain remained, however small, the patient is shown under the heading improved.

The data listed under unrelieved and died at a later period are especially interesting. In eight of the thirty-one unrelieved cases the ulcer was situated at the pylorus. In eleven cases the ulcer was situated at a distance from the pylorus. Eight cases were duodenal ulcers. In four cases the ulcer was not located there were adhesions and probably the ulcers were duodenal.

The interesting point demonstrated by these thirty-one cases is that ulcers situated at a distance from the pylorus, *pylorusferni* are not so greatly influenced by gastro-enterostomy as those situated at the pylorus. First among the causes which are responsible for failure to cure by operation is the development of a post-operative peptic ulcer of the jejunum. This occurred seven times in 334

TABLE I

## GASTRO-ENTEROSTOMY FOR ULCER OF THE STOMACH OR DUODENUM

	Cases
Total number of cases	334
1. Death after operation, 5% (ulcer recent in )	7
Causes of death	
Hemorrhage from ulcer	1
Ascesses following repeated attacks of hemorrhage	
Progression course of ulcer	
Carcinoma vitiosus	
Failure of heart action (4 weeks later)	3
Peritonitis	
Pericystitis	
Paratyphoid	1
1. Ulcers and adhesions	
Recoveries	317
Number of cases operated in 1913	43
Number of cases operated previous to 1913 (107)	
Recent ulcers	26
Cured (recent ulcers in 24)	34
Improved (recent ulcers in 24)	41
Lost sight of	21
Unrelieved (recent ulcers in 5) 7 developed post-operative peptic ulcer	21
Ulcer at pylorus in	8
Ulcer at very long distance from pylorus	
Duodenal ulcer	6
Ulcer not definitely located probably in the duodenum	4
Number of cases who died at later date (recent ulcers in 6)	4
Causes of death known in only	23
Cancer of the stomach	3
Extension of disease	6
Tuberculosis of the lung	5
Slow growth of the kidney	1

One patient became moribund and died. One died from hemorrhage. One from peritonitis. On the anniversary was performed for severe pain and reported hemorrhage and he finally committed suicide. In one there was no record of pain.

gastro-enterostomies. Of this formidable complication after gastro-enterostomy I will speak fully later on.

Finally with regard to the cases shown under the heading "died at a later period," in only a limited number are the causes of death known.

Thirteen patients, or about ten per cent, died of cancer of the stomach. In six the continuance of the growth and the development of the ulcer after the operation were the causes of death. In one of these six cases, the patient developed the morphine habit through the pain he suffered, and died. Another died from hemorrhage. Another died following perforation of the ulcer. Another had very severe pain and hemorrhage. Jejunostomy was performed but the patient committed suicide and finally in one case the pains con-

In a fixed retroflected uterus a pregnancy does not lead to a cure, but generally ends in abortion. But there are exceptions.

Stretching and smoothing out of the adhesions may be attempted as a healing measure by means of massage though this method being tedious and disagreeable has been at present discarded but not rightly. This is best adapted however to cases of ante-flexed uteri and is applicable only in the absence of pus-tubes.

B The replacing and freeing of the uterus and adnexa in narcosis according to the method of Bernhard Schultze and the introduction of a pessary for many patients whose most recent inflammation is long since passed is even to day indicated. We have discarded the method in favor of our operation which owing to its ease and simplicity is to be preferred as a safer method if the patient should require an anæsthetic.

C Patients suffering from adhesions do not readily consent to operations involving laparotomy, nor does the physician as can be readily understood. Abdominal section under very best conditions impairs the continuity of the abdominal wall, the operation necessitates handling of the omentum and intestines, the exposure of individual intestinal loops and the entrance of air especially in the Trendelenburg position. New adhesions may form in many cases in locations, which were previously free therefrom, as shown daily in office practice. In these cases we should resort to vaginal operation, which in cases of perimetritis and chronic periophorosal pyelitis is far more conservative than abdominal section and possesses other advantages viz its ease of application and the patients ready consent. Fixed retroflexions which result from old healed inflammations of the adnexa are better operated vaginally, the Douglas folds being more readily seen. Unless special indications such as appendix complications demand it the vaginal route—being less dangerous alone is justified. Intestine and omentum are scarcely disturbed, but only pushed upward and at the worst a few adhesions are separated. The genital organs are now freed of adhesions, the pouch of Douglas smoothed out and the appendages

are brought forward the ovaries stripped free and finally the tubes may be opened and probed the omentum is pushed aside and the bladder wall easily exposed to view. Whoever would learn this technique is advised to begin with women who have borne children following this with women who have cohabited and are sterile, before attempting the operation on virgins. In order to hold the uterus securely forward, a union of the anterior surface of the uterus to the bladder peritoneum and a proper treatment of the vesico-uterine folds is necessary. Should one find fresh inflammations or bleeding adhesions, then drainage through the pouch of Douglas acts as a safety valve. Adnexa operations by the vaginal route sometimes give rise to it is true to stump exudates, but they disappear far more quickly than after laparotomy. Necrosis is more rare. Inflammations following operations on dirty cases (from tubal contents) may indeed occur but their course is much more favorable than that following laparotomy. This procedure does not contribute to the formation of new adhesions in the abdomen.

Absorbable suture material should be used. Catgut should not be impregnated with iodine. Good hemostasis and drainage bring complete success and prevent the return of symptoms, especially those due to new strong bands or membranous adhesions. Spongy agglutinations will of course always be found on sites disturbed by operation.

Neither for fixation of retroflexions chronically diseased appendages the majority of tubal pregnancies hematoceles nor hematomata is an abdominal operation required. Also many tumors should and must for this reason be operated upon vaginally. Adhesions follow the abdominal route much more frequently than the vaginal. Just as we are in a position to operate upon and extirpate kidney retroperitoneally so should we learn to become proficient in operating and curing without abdominal section diseases which manifest themselves eventually by pelvic adhesions. By practice one learns how to expose the vagina and obtain a broad operative field. In operating the surgeon takes advantage more and more of the

formed by another surgeon. It was a exceptionally difficult case as the whole peptic ulcer together with the loop was excised. I made the blind suture of both openings of the jejunum and then implanted the distal stump into the stomach and the proximal one into the distal. So far the progress of the cure has been rather satisfactory.

TABLE IV  
RESECTION FOR ULCER OF THE STOMACH

Immediate results of the Operation			Subsequent Results			
	Cured	Died	Cured	First Intestinal Loop Relapsed	Operated	Died
Female	24		24			
Male	20		17			
Total	44	0	41			

Of the cases which succeeded in operation: (a) 24 died from peritonitis soon after the leakage of the stomach contents from the incision through the diaphragm and one from chronic pyelitis. (b) one died from hemorrhage from an ulcer back I wound after the operation. (c) one died from perforation of new ulcer. (d) one died from atresia of the gastro-duodenal suture forty-eight days after the operation. Of these men were operated upon in the year 1912 and the balance is too short to estimate results.

What I wish to emphasize is, that whenever possible the peptic ulcer should be excised for I have found in my experience that neither gastro-enterostomy nor jejunostomy are sufficient in themselves, and in many cases both operations combined are of no avail. We have already mentioned among the cases of post-operative peptic ulcer five patients on whom the first gastro-enterostomy was performed by other surgeons. I am therefore somewhat skeptical when I hear surgeons state that they have never met with a peptic ulcer.

In Table IV I have summarized the cases in which the ulcer was excised. In the nine cases of death after operation, the following proved to be the causes. In six cases post-operative peritonitis caused by leakage of gastric juice; in four by leakage of the duodenal stump in one and in one by chronic peritonitis. In one case pyloric resection after Billroth's method No. 2 was done. The ulcer recurred and led to a fatal hemorrhage. The total acidity was enormously high 104, and even resection did not prevent the repeated formation of ulcers. This patient had a very strong tendency to the development of peptic ulcer.

In spite of the severity of gastric ulcer the average time of the ulcer after laparotomy, has repeatedly been shown in constant proportion.

In one case the patient died later from the formation of a new ulcer which perforated. In one case the patient died 48 days after an operation by Billroth's method No. 1. He developed a secondary stenosis of the gastroduodenal suture and died. In this case a gastro-enterostomy might easily have been helpful.

#### RESULTS OF RESECTION

The forty-one cases shown as cured are all quite well but nine of them were operated on only last year.

Under "first improved, afterwards relapsed," we have only one case in which an excision of the ulcer and at the same time a gastro-enterostomy retrocolica posterior was performed, and one case in which a resection by Billroth's method No. 2 was done.

Under "unrelieved" we have two cases. In the first case a wedge-shaped excision of the ulcer was made and this was followed by stenosis at the site of the excision. Gastro-enterostomy antecobra anterior plus entero-anastomosis was performed and since this operation the patient is cured. This is direct evidence against the method of excision of the ulcer and the operation should be replaced by resection. Whether in this case the repeated formation of the ulcer was traceable to a process analogous to the formation of a peptic ulcer must be left undecided. Wedge-shaped resection can easily lead to a sharp kinking of the vessels and so may lead to a disturbance in the circulation and its resulting consequences (such as cicatrices—perforations).

In the second case resection by Billroth's method No. 2 was performed in 91. The patient had a recurrence of the trouble.

Under "died" we have two cases one dying after three years from stomach trouble probably carcinoma one after three years and two months, from cancer.

#### SUBSEQUENT RESULTS OF RESECTIONS WITH REFERENCE TO THE METHOD OF OPERATION

Table V shows good results. Forty-one cured. In one case of improvement resection by Billroth's

method No. 2. It should be noted that the patient was well for one and one half years and then began to suffer pain in the left side. The single case of excision which was not cured had a second laparotomy performed on account of recurring trouble. In spite of a wedge-shaped resection a stenosis of the stomach had developed.

TABLE V  
SUBSEQUENT RESULTS OF RESECTION  
WITH REFERENCE TO METHOD OF OPERATION

Operation	Cured	Form Improved Later Relapsed	Died
Transverse resection of stomach			
II Broch II	171		
Zeremon plus gastro-enterostomy			
Zeremon alone			
Total			

Of these eight were operated on in the year 1912

Finally in a series of cases jejunostomy alone was performed. We need not wonder at the high mortality of the operation, as it was performed in the weakest and the worst cases, when the conditions were so complicated that nothing else was possible or where the patients were so weak and worn out that one could only do the shortest operation possible under local anesthesia.

There were twenty four cases with twelve deaths, and eight of these died of peritonitis, one of hemorrhage from the ulcer, in other words, hemorrhage in spite of the jejunostomy, one from tubercular complications, one from degeneration of the heart muscle, and one of marasmus. Twelve cases survived the operation but two died later, both of carcinoma. One case was improved, four cases were lost sight of, and five cases were completely cured.

On the basis of our observations we are able to lay down the following rules for the choice of method of operation:

1. In the perforation the best method is immediate jejunostomy with irrigation of the peritoneal cavity and closure of the site of the perforum. When gastro-enterostomy should be done afterward depends on the situation of the ulcer and the general condition

of the patient. If the patient is so weak that a gastro-enterostomy is out of the question, and can eat nothing on account of the peritonitis being already far advanced then jejunostomy is the simplest operation as it makes it possible to feed the patient immediately after the operation.

2. I will remark here that in the other complication of ulcer which we fear so much namely hemorrhage, it is better not to operate. When the hemorrhage is severe expectant treatment is the best, for it has repeatedly occurred at the operation that the bleeding point could not be found. This is one of the most hopeless situations in which a surgeon may find himself for the patient may die during the operation. On the other hand, it is surprising how much blood a patient may lose without dying. One can stop a good deal of hemorrhage with rest in bed, ice bags in stomach, injections of gelatine serum of horses, the administration of calcium lacticum. In hopeless cases we can make a trial of strong silver nitrate 1 in 100 solution for irrigation. In extreme cases, jejunostomy should be performed as one can give the stomach absolute rest and at the same time give the patient nourishment. If the hemorrhage is severe but has stopped for the time being one should operate at once before the hemorrhage recommences.

3. In typical stenosis of the pylorus especially in the case of a long standing ulcer where no new symptoms have occurred gastro-enterostomy is the operation to be selected. Sixty per cent of the cases of stricture of the pylorus are completely cured by gastro-enterostomy while in the cases of open ulcer gastro-enterostomy is successful in only 41 per cent of cases. Among 334 gastro-enterostomies for ulcer of the stomach and duodenum and its complications seven deaths occurred. Of these eight (nearly one half) were caused by continued bleeding from the ulcer. Therefore gastro-enterostomy is not in all cases a complete protection against continuance of the hemorrhage.

4. Unilateral pyloric resection (which I did first in 1894) offers the greatest security in dealing with ulcer and its complication. It should receive special consideration in cases

formed by another surgeon. It is an exceptionally difficult case as the whole peptic ulcer together with the loop was excised. I made the blind suture of both openings of the jejunum and then implanted the distal at its point the stomach and the proximal one into the distal. So far the progress of the cure has been rather satisfactory.

TABLE IV  
RESECTION FOR ULCER OF THE STOMACH

Immediate Results of the Operation		Subsequent Results				
	Cured	Died	Cured	First Improved Later Relapsed	Alive	Died
Females	34		34			
Males	30					
Total	64	0	41			

Of the cases which succeeded in operation: (a) one died from peritonitis four days from the leakage of the stomach contents, one died from leakage through duodenal stump and one from chronic peritonitis. (b) one died from hemorrhage from an ulcer which appeared after the operation. (c) one died from perforation of the ulcer of the stomach. (d) one died from perforation of the gastroduodenal anastomosis forty-eight days after the operation. Of cases which were operated upon in the year 1911 and the interval is too short to estimate results.

What I wish to emphasize is that whenever possible the peptic ulcer should be excised for I have found in my experience that neither gastro-enterostomy nor jejunostomy are sufficient in themselves, and in many cases both operations combined are of no avail. We have already mentioned among the cases of post operative peptic ulcer five patients on whom the first gastro-enterostomy was performed by other surgeons. I am therefore somewhat skeptical when I hear surgeons state that they have never met with a peptic ulcer.

In Table IV I have summarized the cases in which the ulcer was excised. In the nine cases of death after operation the following proved to be the causes. In six cases post operative peritonitis, caused by leakage of gastric juice in four by leakage of the duodenal stump in one and in one by chronic peritonitis. In one case pyloric resection after Billroth's method No. 2 was done. The ulcer recurred and led to a fatal hemorrhage. The total acidity was enormously high 104 and even resection did not prevent the repeated formation of ulcers. This patient had a very strong tendency to the development of peptic ulcer.

In spite of the strongly acid gastric juice, the ulcer was highly selected, and gastric juice of this character has been shown to be not

In one case the patient died later from the formation of a new ulcer which perforated. In one case the patient died 48 days after an operation by Billroth's method No. 1. He developed a secondary stenosis of the gastroduodenal suture and died. In this case a gastro-enterostomy might easily have been helpful.

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In the second case resection by Billroth's method No. 2 was performed in 1911. The patient had a recurrence of the trouble.

Under "died" we have two cases: one dying after three years from stomach trouble, probably carcinoma; one after three years and two months, from cancer.

#### SUBSEQUENT RESULTS OF RESECTION WITH REFERENCE TO THE METHOD OF OPERATION

Table V shows a good result. Forty-one cases were cured. In one case of improvement followed by relapse, resection by Billroth's

method No. 2 it should be noted that the patient was well for one and one-half years and then began to suffer pain in the left side. The single case of excision which was not cured had a second laparotomy performed on account of recurring trouble. In spite of a wedge-shaped resection a stenosis of the stomach had developed.

TABLE V  
SUBSEQUENT RESULTS OF RESECTION  
With Reference to Method of Operation

Operation	Cured	First Improved Later Relapsed	Dead
Transverse resection of stomach			
Billroth II	191		
Excision plus gastro-enterostomy			
Excision alone			
Total			

Of these eight were operated on in the past year.

Finally in a series of cases jejunostomy alone was performed. We need not wonder at the high mortality of the operation, as it was performed in the weakest and the worst cases, when the conditions were so complicated that nothing else was possible or where the patients were so weak and worn out that one could only do the shortest operation possible under local anaesthesia.

There were twenty four cases with twelve deaths, and eight of these died of peritonitis, one of haemorrhage from the ulcer—in other words, haemorrhage in spite of the jejunostomy, one from tubercular complications, one from degeneration of the heart muscle and one of marasmus. Twelve cases survived the operation but two died later both of carcinoma. One case was improved four years were lost sight of and five cases were completely cured.

On the basis of our observations we are able to lay down the following rules for the choice of method of operation:

1. For acute perforation the best method is immediate laparotomy with irrigation of the peritoneal cavity and closure of the orifice of the perforation. Whether gastro-enterostomy should be done afterward depend on the situation of the ulcer and the general con-

dition of the patient. If the patient is so weak that a gastro-enterostomy is out of the question, and can eat nothing on account of the peritonitis being already far advanced then jejunostomy is the simplest operation as it makes it possible to feed the patient immediately after the operation.

2. I will remark here that in the other complication of ulcer which we fear so much namely haemorrhage, it is better not to operate. When the haemorrhage is severe, expectant treatment is the best, for it has repeatedly occurred at the operation that the bleeding point could not be found. This is one of the most hopeless situations in which a surgeon may find himself for the patient may die during the operation. On the other hand, it is surprising how much blood a patient may lose without dying. One can stop a good deal of haemorrhage with rest in bed, ice bags to stomach, injections of gelatine serum of horses, the administration of calcium lactum. In hopeless cases we can make a trial of strong silver nitrate 1 in 100 solution, for irrigation. In extreme cases, jejunostomy should be performed as one can give the stomach absolute rest and at the same time give the patient nourishment. If the haemorrhage is severe but has stopped for the time being one should operate at once before the haemorrhage recommences.

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## CONTRIBUTION TO THE DISCUSSION ON THE CHOICE OF OPERATION IN CHRONIC GASTRIC AND DUODENAL ULCERS

By JAMES SHERRIN F.R.C.S. LONDON, ENGLAND

**T**HE operation to be performed in any individual case of chronic gastric ulcer can be decided only after the abdomen is opened. General rules, however, can be laid down from a study of the post-operative progress of a series of patients treated by individual surgeons by varying methods.

My contribution to this discussion is based upon a personal operative experience of 200 cases of chronic gastric ulcer (*vide* Appendix A) and 224 cases of chronic duodenal ulcer. These figures include only those in which an unhealed chronic ulcer was present, and exclude operations for acute perforation of both acute and chronic ulcers and those in which scarring had produced symptoms, the ulcer being healed.

There is good ground for belief that ulcers of the stomach and duodenum are associated with and secondary to disease in and around other viscera, particularly the appendix. It is therefore clear that the whole abdomen should be thoroughly examined and in most cases the appendix removed, except when the patient is seriously ill from hemorrhage or perforation. In my earlier cases I neglected this and have since had to operate for the removal of gall stones and chronic appendices overlooked at the original operation.

The treatment of chronic duodenal ulcer consists in infolding the ulcer when it is in its usual situation on the anterior wall and performing posterior gastrojejunostomy.

In my series there were four deaths all in men over 60 years of age, three from broncho-pneumonia, and one from acute oedema of lungs 24 hours after operation.

The results of gastrojejunostomy in this condition are in my experience unequalled by any other operation.

A hundred of the cases have now been operated upon more than two years. The operative death rate was two. Three have since died from other causes, six, five, and three years after operation remaining quite well. One

died a few months later after prostatectomy. Eighty five have remained in perfect health.

Two developed jejunal ulcers after eleven and six months respectively. Operation was successfully carried out two and one-half years ago and fifteen months ago, both patients remaining in perfect health. In the whole series I have had to operate upon five, without a death.

Three patients complain of occasional discomfort but are much better. The remainder I have been unable to trace.

A result such as this in my opinion establishes gastrojejunostomy as the operation of choice in cases of chronic duodenal ulcer.

Acute perforation of a chronic duodenal ulcer is by no means an infrequent complication and should be treated by closure or excision followed by gastrojejunostomy.

I have been able to carry out this treatment in fifteen cases with one death, a patient who was suffering also from genito-urinary and pulmonary tuberculosis.

I consider gastrojejunostomy an essential part of the treatment and always carry it out except in the "too-late" cases. In all the survivors in whom this was not done I have since had to carry it out and have also operated upon five cases in which perforations were closed by other surgeons.

I have entirely abandoned irrigation of the peritoneal cavity and instead gently sweep away any exudate, close the operative wound and drain through separate incision when necessary.

All surgeons who have had a wide experience of the treatment of gastric ulcer have found that gastrojejunostomy fails to bring about healing in certain cases, and that a relapse occurs in many of those operated upon by excision alone.

Some state that while gastrojejunostomy is a satisfactory procedure in cases of chronic ulcer producing pyloric obstruction it has not been successful when the ulcer is situated elsewhere. Such however is not an experience (*vide* Appendix B). Simple closure

organs, as nothing except removal of the ulcer will be of any real assistance. Transverse resection as planned by Riedel, also warmly advocated by Payr and Kuttner is a relatively safe operation. Up to January 1914, we had performed twelve transverse resections to which six more cases may be added up to July 1 1914, making eighteen in all and there has not been a single death. I have never seen a peptic ulcer or any other harmful result after this operation.

When transverse resection cannot be done Billroth's method No. 2 should be employed. Billroth's method No. 1 is the third choice. Partial excision is to be rejected entirely.

Only in extreme cases, when other operations are not feasible, jejunostomy may be considered as has already been suggested in cases of perforated ulcer when the patient is so weak that he must be fed immediately after the operation. Jejunostomy makes it possible for nourishment to be given even on the operating table. Further in cases of peptic ulcer in which for exceptional reasons excision is not possible it is the easiest and most rapid of all operations for gastric ulcer and above all it leaves the stomach undisturbed. As it has been done only in extreme cases one cannot wonder that it has met with so little success and that noticeably so many cases of peritonitis have been associated with it. There were patients whose peritoneum had lost its power of resistance.

#### A FEW REMARKS ON THE TECHNIQUE OF THE OPERATIONS UNDER DISCUSSION

In my clinic gastro-enterostomy is done whenever possible after the method of Ha. Kr. retrocolica posterior with a quite short loop or better said without any length of bowel between the stomach and jejunum. The transverse mesocolon is found and an aperture is made in a part comparatively free from blood vessels. Through this opening the stomach wall is pulled forward and then secured with a Doyen's clamp at a place which is as near as possible to the greater curvature. The small intestine at the junction of the duodenum and jejunum is brought to this spot and sutured. I will not go into a detailed description of the suturing. It is done in the

typical way after Wölfler's method. First inner seromuscular suture second inner mucous suture third outer mucous suture fourth outer seromuscular suture and then a few Lembert sutures added. It appears to me of especial importance that the slit in the mesocolon should be properly sutured.

In Koenigsberg I once had an opportunity of observing a case of ileus in which a mesocolon slit made during a laparotomy was left unsutured by my predecessor in the professional chair. This led to an internal strangulation. Since this experience I have always been especially careful in suturing the slit. Finally a short time ago we had had case in our clinic, which after a gastro-enterostomy the suture which secured the slit to the stomach gave way and led to an internal strangulation.

#### THE TECHNIQUE OF PYLORIC EXCLUSION

The stomach is divided between two Kocher clamps by a Paquelin canter and both proximal and distal ends are sewn by a continuous suture while the clamps are on. After removal of the clamps a further suture beyond the first one is put in for safety. I lay very great stress on the importance of the fact that in unilateral exclusion the nerves of the stump may be severed. This happens only when they are cut through and not when simply a band or fold of fascia is laid around.

#### THE TECHNIQUE OF TRANSVERSE RESECTION OF THE STOMACH

One is always astonished how far the two cut ends of the stomach retract after removal of the central portion, and he fears that the transverse suture will not be possible. However it is easier than one would think. It is necessary when doing this operation to supplement the longitudinal incision in the abdominal wall with a transverse incision in order to get plenty of room.

#### THE TECHNIQUE OF JEJUNOSTOMY

This is especially simple and the method has not changed since I described it in 1894. It is merely adopting the principle of Witzel, substituting jejunum for stomach. I would emphasize especially this point that the catheter should not be introduced into the intestine at any point lying higher in the abdomen than the umbilicus otherwise it may lead to a kinking of the intestinal loop.

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Some state that while gastrojejunostomy is a satisfactory procedure in cases of chronic ulcer producing pyloric obstruction, it has not been successful when the ulcer is situated elsewhere. Such, however, is not my experience (*vide* Appendix B). Simple chronic

gastric ulcers, wherever situated, will heal as the result of gastrojejunostomy correctly performed unless they are adherent and have perforated, their floor being formed by pancreas or liver thus preventing the contraction necessary to sound healing.

I am convinced that gastrojejunostomy alone so modifies gastric conditions that ulcers heal and that only when complications have arisen is excision or partial gastrectomy necessary.

I have had the opportunity of proving this in six of my series in whom chronic ulcers situated on the lesser curvature had been treated by gastrojejunostomy alone. In three cases I had to operate again for causes unconnected with the ulcer or original operation, and in three was able to examine the stomach after death from other causes more than two years after operation. In all, the ulcer had perfectly healed.

Although gastrojejunostomy alone is curative in the majority of cases it should not become the sole routine procedure. My present practice is to perform gastrojejunostomy in every case the posterior vertical no-loop operation by preference or if this is impossible from adhesions or the situation of the ulcer the anterior no-loop operation which I first carried out ten years ago and described in 1907 in which a portion of jejunum close to the duodenojejunal flexure is brought through the transverse mesocolon and gastroduodenal omentum and united to the anterior surface of the stomach the edges of the opening through the great omentum being sutured to the stomach around the anastomosis.

Unless debarred by the situation of the ulcer the anastomosis should be made to the pyloric segment of the stomach. In the case of ulcers which have produced, or are likely to produce, hour-glass stomach care should be exercised that the stomach is to their cardiac side. Before performing the anastomosis the ulcer is carefully examined. Small ulcers I usually incise with mattress sutures of silk. If suspicious of malignancy or if the floor of the ulcer is formed of pancreas or liver I carry out excision in addition.

After excision alone recurrence of ulceration is common. It should never be done except as a complement to gastrojejunostomy.

When there is indication for excision and the ulcer is large I believe partial gastrectomy is preferable to simple excision and gastrojejunostomy. During the last two years I have after closing the duodenum, brought the jejunum at its origin through an opening in the transverse mesocolon and united it directly to the divided cardiac end of the stomach. This makes the operation simpler and shorter. Convalescence is as uneventful as when the stomach is closed and a separate anastomosis is carried out.

In no instance have I found it necessary to practice any method of pyloric exclusion.

It has been urged that every chronic gastric ulcer should be excised on account of the possibility of its being or becoming malignant. While I am a firm upholder of the opinion that in a certain percentage of cases carcinoma of the stomach follows directly on chronic gastric ulcer I believe that promiscuous excision would lead to a greater mortality than that which would follow from the carcinoma that might develop if they were treated by gastrojejunostomy alone.

In none of the cases operated upon for chronic gastric ulcer by gastrojejunostomy alone in which I had no doubt of the simple nature of the lesion, has carcinoma developed.

On the other hand in two cases of chronic duodenal ulcer a note was made at the time of the original operation that the ulcer had spread to the stomach. In both, malignant disease of the stomach supervened and the patients again came under observation on account of fresh gastric symptoms about eighteen months later. I was able to perform partial gastrectomy in one, and the sections showed the growth starting in the edge of a chronic gastric ulcer in both the duodenal ulcer had completely healed.

In forty-one cases in which the ulcer was excised a simple and in all of which serial sections were cut and examined in the London Hospital Pathological Institute in none was carcinoma discovered. In four of these cases, however, in which excision was carried out on account of the suspicious nature of the

ulcer carcinoma was starting in the edge of the chronic ulcer in three the other proved to be a lymphosarcoma.

When hour glass stomach has supervened gastrojejunostomy on the central side of the obstruction—single if there is one obstruction only double if two or more—the most satisfactory operation. The indication for excision or partial gastrectomy is the same as in ulcer without this complication.

Acute perforation of a chronic gastric ulcer is a rare event which should be treated if the condition of the patient admit by closure or excision of the ulcer followed by gastrojejunostomy.

Hæmorrhage in chronic ulcer call for operation as soon as possible after the first attack usually within the first twenty-four hours. The ulcer should be directly treated by ligature of the vessel on each side of it, by inversion or excision followed by gastrojejunostomy.

Treated on these lines the result of the operative treatment of chronic gastric ulcer both immediate and remote are excellent. Among 200 cases excluding those in whom perforation had occurred but including those in whom the immediate indication for operation was hæmorrhage (14 cases 1 death) there was 6 deaths the detail of operation are given in the appendix.

The results of cases operated upon more than two years by all methods are briefly as follows.

One hundred and twenty-one were reoperated on more than two years ago with 4 operative deaths 100 of the survivors were treated for more than two years 99 of these remained perfectly well five are better but not quite well. Only one recidived no relapse of my early case a woman in whom there were extensive adhesions to the spleen and left lobe of the liver treated by gastrojejunostomy alone. In four patients second operations became necessary two to excise portions of ulcer which were adherent to the pancreas and two for true jejunal ulceration.

There is no difference whatever in the result in those cases operated on for ulcer at a distance from the pylorus and those at the pylorus or in those in which the ulcer was excised in addition to gastrojejunostomy.

I know of no case in which fresh ulceration occurred except after excision alone or in which recurrence of symptoms took place after a lapse of more than two years.

In conclusion I would say that gastrojejunostomy still remains the operation of choice in chronic duodenal ulcer and in the large proportion of cases of chronic gastric ulcer if only when complications have arisen that excision has to be added to the operative treatment.

#### APPENDIX

Up to July 30 1914 I had operated upon two hundred cases of unperforated chronic gastric ulcer, thus as death.

The following are the operations performed (1) only three camp and 1 by hour glass stomach separated (1 isolated).

As to the results. One death (1 patient) in whom the ulcer was removed and the pylorus ligated. The patient died several weeks later.

I have had 100 patients reoperated on. 3 only for the ulcer itself. 97 for other causes. 1 death one from colic gastric dilatation, one from pyloric stenosis.

Of the 100 patients who were reoperated on (one from hæmorrhage, the result of erosion of the pyloric artery two years after operation the other from perforation ulcer of the pylorus).

In the 100 cases of ulcer of the stomach the following were the operations carried out.

1. 100 cases of ulcer of the stomach. 18 cases of death 1 died after operation—patient had been having repeated attacks of hæmorrhage. At post mortem it was found that there was

extensive erosion of the pylorus.

2. 100 cases of ulcer of the stomach. 18 cases of death 1 died after operation—patient had been having repeated attacks of hæmorrhage. At post mortem it was found that there was

extensive erosion of the pylorus. 3 cases of death 1 died after operation—patient had been having repeated attacks of hæmorrhage. At post mortem it was found that there was extensive erosion of the pylorus.

Second operations were carried out for recurrence of symptoms in 100 patients in 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

I have had 100 patients reoperated on. 3 only for the ulcer itself. 97 for other causes. 1 death one from colic gastric dilatation, one from pyloric stenosis.

dearly four days after operation and no abdominal cause was discovered at the post mortem examination. The operation in the former was carried out over two years ago, he remains quite well. In both patients the ulcer had been excised in addition to gastrojejunostomy.

Five died from other diseases remaining quite well more than two years: two died at eight, one at seven, and two at three years after operation; one died at eighteen, and two at ten months after operation, from other causes. I have failed to trace the remainder but nine of them I watched for more than two years; one, five years after operation, was better but not quite well; the others were quite well at seven, six, five, four, three and two years.

#### APPENDIX B

In 1913 I published the late results: twenty-one cases of non-obstructive ulcer treated by gastrojejunostomy alone. Fifteen were quite well at periods varying from two to eight years; two had died from other causes; two and three years after operation having had entire relief; three were almost well and only one woman who had had a large ulcer at the cardiac end of the stomach, adherent to the spleen, had obtained no relief.

Seventy-eight cases of this type treated by gastrojejunostomy without excision have now been operated on more than two years. There was one death from bronchopneumonia nine days after operation. I have been able to ascertain the present condition of sixty-six; fifty-four are and have re-

mained perfectly well at the following periods: nine years, three, eight years, one, seven years, three, six years, four, five years, seven, four years, ten, three years, thirteen, two years and over thirteen and they have needed no further treatment. Seven died of causes other than gastric, remaining perfectly well till death: one, seven years, one, four years, two, three, years, one, two years, one, eighteen, and one six months, after operation. Three were lost sight of when quite well: four years after operation, one after two years, one after one, and two after few weeks.

Two patients had to be operated on again and ulcers excised which had perforated and were adherent to pancreas. In both the original ulcer had been saddle shaped: the anterior portion and that on the lesser curvature had completely healed. In one ten months after gastrojejunostomy for large saddle shaped ulcer on the lesser curvature I removed gall-stones; the ulcer had healed. That is now four years ago and the patient remains in perfect health. In the other cases I had to operate about two years later and removed chronically inflamed appendices; these ulcers had also completely healed. If these are included the number of those quite well is 57. Six of the others are much better and only one, previously mentioned, is unrelieved. In no instance did malignant changes supervene.

Of 77 who survived the operation, 66 are or remained quite well for more than two years after operation, six are much better but not quite well; two required further operative treatment, one was not relieved; the remainder were lost sight of within the first two years after operation or died during this period of causes unconnected with the stomach.

ANKYLOSIS: AN EXPERIMENTAL STUDY<sup>1</sup>

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THIS experimental study was undertaken for the purpose of investigating the changes that take place in the tissues of the joint during the process of ankylosis. In a previous study (1) on the mobilization of ankylosed joints, it was observed that there was a marked difference in the reaction to injury between epiphyseal and diaphyseal bone. In the experiment reported there was fibrous union between two demarcated joint surfaces at the end of sixty days. At the end of this time there was no evidence of bony ankylosis. A further study of this process was carried out in the experiment here reported with the belief that the facts gained will aid in the surgical treatment of ankylosed joints.

Hoffa (2) has defined ankylosis as the condition in which two or more joint surfaces become bound together and immovable. He distinguished three types: an interarticular fibrous ankylosis, an interosseous fibrous ankylosis, and an osseous ankylosis. True bony ankylosis, according to Hoffa, may be produced in two ways: sometimes there is transformation of the connective tissue of a fibrous ankylosis directly from a cartilage metaplasia at other times following the destruction of cartilages from inflammatory diseases bony union develops from the bone marrow and periosteum.

Nichols and Richardson (3) from the study of sixty-seven cases of non-tuberculous arthritis, divide this condition into two types: namely, a proliferative type and a degenerative type. In the degenerative type there is a tendency to destruction of joint cartilage with deformity and no ankylosis. An arthropathy such as a Charcot joint is typical of this class. In the proliferative type there is destruction of joint cartilage leading to ankylosis of adjacent joint structures; the earliest

change is a proliferation of the synovial membrane at the insertion of the joint capsule. This leads to a pannus growth which advances over the cartilage at times uniting the two joint surfaces and destroying the underlying cartilage. Accompanying this process there may be destruction of the joint cartilage on its epiphyseal surface by granulation tissue from the marrow spaces. These investigators believe that the destruction of cartilage by the pannus growth predominates, though either process leads to fibrous ankylosis. True bony ankylosis according to Nichols and Richardson, may be produced in three ways. In certain instances there is a proliferation of the perichondrium which is readily transformed into cartilage or bone or either in tumors new bone production results from osteoblasts which have their origin in the bone marrow. Finally in rare instances there is a direct transformation of fibrous tissue into bone.

Ashrauer and Pil (4) and Kroh (5) have described joint changes resulting from injury in experimental studies of arthritis deformans. In the literature above referred to various joint changes have been described but the sequence of these changes and the duration of the ankylosing process have not been made clear.

The object of these experiments was the study of the nature, sequence and duration of the tissue changes which lead to bony ankylosis. In these experiments the knee-joints of dogs were used. All experiments were done under complete ether anesthesia. All operations were done under a careful aseptic technique. Post-operative care of the animals used was such as to insure as little suffering as possible. All animals were sacrificed with chloroform. Four experimental methods were used.

I. Partial excision of joints, eight experiments

II. Destruction of joint-cartilage three experiments

III. Injury to joint-cartilage two experiments

IV. Direct infection of normal joints seven experiments

#### I. PARTIAL EXCISION OF JOINT

The knee joint was opened by a lateral longitudinal incision the patella and its tendon were displaced medialward the cruciform ligaments were divided. The knee was completely flexed and 1 cm. of the lower end of the femur and 0.5 cm. of the upper end of the tibia removed with a saw. The joint was then closed with interrupted fine silk sutures and held fixed by a plaster of Paris dressing.

Experiment No. 10. Partial excision of knee-joint. Third day Dog well plaster in good condition. Sixth day Dog well sacrificed. Knee joint removed and capsule opened by a circular incision. The bones are in good apposition. Between the bone ends there is a layer of fresh granulation tissue about 1 mm. in thickness, which can be easily separated from the bones. Joint fixed in formalin. Microscopical sections prepared.

*Microscopical study.* Sections show the bone ends to be separated by a thin plate of fibrin. There is a narrow zone of granulation tissue along the free margins of the bone surfaces. There are new blood vessels growing out into the fibrin accompanied by strands of fibroblasts. There are numerous small fragments of bones which are necrotic and which are surrounded by large polymorphonuclear phagocytic cells. In a few places there are small islands of osteoid tissue which seem to represent bone destruction. There is no new bone formation. The bone-marrow of the epiphyses is very rich in lymphoid cells, except for a narrow zone along the cut margin of the bone which contains few lymphoid cells.

Experiment No. 1. Partial excision of knee joint bones sutured in apposition by two silver wires. Fifth day Animal in good condition. Ninth day Animal found dead autopsy failed to reveal cause of death.

Operative wound healing *per primam*. Joint removed, fixed in formalin, and decalcified.

*Microscopical study.* A median longitudinal section through the joint shows the bones in good approximation (Fig. 1). The epiphyses are incompletely ossified. The space between the ends of the bones is filled in large part by blood clot which is being organized by granulation tissue growing from the marrow spaces (Fig. 2). Scattered through the blood clot are numerous bone fragments which show evidence of absorption. No new bone formation no regeneration of cartilage. At the margin of the condyle there are small processes of granulation tissue growing from the marrow into the cartilage. The saw-cut in the tibia has gone through the posterior aspect of the epiphyseal line, and here there is a small nodule of new formed bone.

Experiment No. 3. Partial excision of knee joint. Fourteenth day Dog well plaster bandage in good condition. Nineteenth day Animal found dead cause not known. Operative wound healed *per primam*. Joint removed and microscopical preparation made.

*Microscopical study.* Ends of bones in good position. The space between varies from 1 mm. to 5 mm. The tissue between the bone ends is composed of moderately densely packed spindle-cells, among which there are numerous large thin-walled blood vessels. Midway between the bones there is a small area of a densely eosin-staining fibrin network evidently old unorganized blood-clots. Scattered here and there are small fragments of bone which are being absorbed. The ends of the bones show the cancellous bone exactly as left by the saw. There is no new bone formation. There is complete fibrous ankylosis (Fig. 3).

Experiment No. 4. Partial excision of knee joint bones held in apposition by a silk ligature and plaster of Paris dressing. Seventh day Dog in good condition plaster bandage intact. Twenty first day Dog in good condition plaster bandage removed. Passive motion present operative wound healed *per primam*. Thirty-fifth day Dog in good condition knee held flexed extension limited. Fifty-fifth day Animal sacrificed knee joint removed. Specimen allows free motion in

elasticity of the ligaments in order to draw the organs downward. Only the part which at that time will be operated upon need be drawn forward. In operations on a tube or ovary it is not advisable to continuously pull or hold forward the body and portion of the uterus.

Operating vaginally without the Trendelenburg position is an enormous advantage since thereby the entrance of air into the abdominal cavity is practically excluded.

I concede in the first place that the vaginal route does not appear so simple for the operator and certainly everything cannot be done by way of the vagina, but the abdominal route is more dangerous and is followed by more disturbances. The patient will much

more readily consent to an operation which does not necessitate abdominal incision and thus we will be in a better position to cut short the illness and insure a favorable outcome.

The removal of the consequences of chronic pelvic adhesions without injury to the abdominal parietes is one of the greatest tasks of gynecology. The vaginal route renders this possible. At the present time we can say that any interference with the abdominal organs is only very exceptionally indicated. With this end in view we travel the same path as Nature does in her efforts to heal pelvic disorders by insuring healing of the diseased pelvic organ and their complete isolation from the abdominal cavity.



Fig. 10 Experiment No. 5 Partial excision of knee joint, 9 days. Medial longitudinal section of entire joint showing femur (F), tibia (T). The space between the ends of the bones (X) is filled with organizing blood clot.



Fig. 11 Experiment No. 5 High power photomicrograph of the edge of the femur adjacent to X shown in Fig. 10. B cancellous bone of the epiphyses of the femur. C old blood-clot. G granulation tissue in the marrow.

areas, which show a marked change. The lower end of the femoral diaphysis has undergone marked atrophy, being separated completely from the epiphysis. The femoral epiphysis is joined to the tibia by a mass of dense fibrous tissue which contains very few blood vessels. At the junction of this fibrous tissue and the cancellous bone of both the femur and tibia there is a zone of tissue which contains numerous large blood spaces. The cells which make up this tissue are spindle cells arranged in strands and whorl about the blood spaces. Scattered here and there are bone fragments which are being absorbed. In other areas the connective tissue cells are encapsulated and there is a hyaline intercellular matrix in which there is deposit of calcium salt. These areas are the same as in Fig. 13.

Experiment No. 5. Partial excision of knee joint, joint fixed in complete extension in plaster of Paris bandage. Twenty-seventh day. Dog at a wound healed knee allows slight motion plaster of Paris dressing removed. Fortieth day. Dog in good condition.

joint stiff. Radiogram shows excellent position bones in apposition in complete extension (Fig. 11). One hundred and eighteenth day. Dog has been in good condition. Knee is stiff. Animal sacrificed. Knee-joint removed. Radiogram (Fig. 12) shows bony union. Microscopical sections prepared.

*Microscopical study.* Medial longitudinal sections show joint cavity obliterated except for a very small slitlike space between the quadriceps tendon and the anterior surface of the femur. The joint cartilage of the patella has been completely replaced by fibrous tissue. The femur and the tibia are joined by cancellous bone. The line of union is only distinguished by slightly thickened and irregular trabeculae (Fig. 13).

*Summary.* In these experiments in which the joint was partially excised and the cancellous bone surfaces of the epiphyses were approximated there was produced the simplest experimental condition for the study of the development of bony ankylosis. This condition is the same as that which is produced in a surgical operation for the mobilization of an osseous ankylosis.

These experiments show that ankylosis by bone is a process which develops locally.

flexion extension is checked at 20 degrees from complete. No lateral motion.

*Microscopical study* Section shows that the cut ends of the bones are not in close apposition. The tibia is flexed, and the patellar tendon lies over the cut surface of the femur to which it is adherent by a mass of fibrous tissue (Fig. 4). The joint cavity is entirely obliterated by a mass of dense fibrous tissue. In this mass are two irregular slitlike cavities, lined with cells that have the characteristics of synovial endothelium (Fig. 5). It seems probable that it is such spaces as these that have been interpreted as artificial joint cavities resulting from the interposition of various substances (Sumita [6]). There is no new bone formation, and no regeneration of cartilage.

Experiment No. 8. Partial excision of knee-joint. Seventh day. Animal well. Plaster bandage in good condition. Fifteenth day. Plaster bandage removed. Operative wound healed *per primam*. Joint allows free motion. Plaster bandage reapplied. Twenty-third day. Plaster bandage in good condition. Radiogram taken through plaster bandage shows bones held in apposition at 60 degrees flexion. No evidence of bony union. Thirty-fifth day. Plaster bandage removed. Knee not swollen or tender. *passive* motion allowed through 45 degrees. Plaster bandage reapplied. Forty-fourth day. Plaster bandage removed. Small amount of motion. Animal in good condition. Plaster bandage reapplied. Sixty-fourth day. Plaster bandage in good condition. Animal well. Sacrificed. Plaster bandage removed from limb. Radiogram (Fig. 6) taken shows no evidence of bony union. Microscopical preparation made.

*Microscopical study* Sections show bones in close apposition (Fig. 7). The joint cavity between femur and tibia is entirely obliterated. The space between the femoral condyles and the patella remains. The femur and tibia are joined by a mass of dense fibrous tissue containing relatively few blood vessels. There is no bony union. Along the margins of the cut surfaces of femur and tibia the trabeculae are markedly thickened. The marrow spaces here contain numerous thin-walled blood-vessels and few lymphoid cells.

At the junction of the cancellous bone and fibrous tissue there are numerous multiloculate granular cells. The cartilage over the anterior surface of the condyles and patella is thin. Between the femur and patella there are numerous villi composed of myxomatous tissue and covered with synovial endothelium.

Experiment No. 2. Partial excision of knee joint. Silver wire suture used to hold bones in apposition. Plaster of Paris bandage. Fifth day. Animal well. Foot swollen. Plaster bandage removed. Limb put in splint bandage. Sixteenth day. Wounds healed. Dog well. Limb held flexed. Knee-joint thickened. Very little motion, with crepitus. Sixty-fourth day. Dog well. Knee stiff. Radiogram (Fig. 8) taken shows a suggestion of bony union. Eighty-sixth day. Dog sacrificed. Knee joint removed. Microscopical sections prepared.

*Microscopical study* Sections show the bones in good apposition (Fig. 9). The femoral epiphyseal line is intact, but the saw cut in the tibia has passed through the epiphyseal line. There is no bony union. The bones are united by a mass of dense fibrous tissue within which there are several small slitlike cavities lined with flattened cells, similar to those described in Experiment No. 4.

Experiment No. 7. Partial excision of knee joint. Silver wire suture used to hold bones in apposition. Plaster of Paris dressing. Fourth day. Joint slightly swollen and tender. Plaster removed. Small amount of discharge. Thirteenth day. Dog in good condition. Slight discharge from wound. Twenty-first day. Dog in good condition. Wound healed. Thirtieth day. Dog well. Radiogram taken shows bones in poor position. Head of tibia dislocated medialward. Flexion of 60 degrees. Fifteenth day. Dog well. Knee allows very little motion. One hundred and twentieth day. Dog well. Knee stiff. One hundred and forty-fourth day. Dog sacrificed. Knee joint removed. Joint is thickened. Specimen allows slight motion at joint. Microscopical sections prepared.

*Microscopical study* Median longitudinal section cut. The joint cavity is entirely obliterated. The patella is of normal shape. It is united to the femur by a mass of dense fibrous tissue. The joint-cartilage of the patella has disappeared except for a few small



Fig. 6  
Fig. 7

Fig. 6 Experiment N. 8 Partial excision of knee joint 64 days. X-ray photograph. F femur T tibia P patella. Note that the ends of the bones are not directly separated. Compare with Fig. 8.

Fig. 7 Experiment N. 8 Partial excision of knee joint 64 days. Median longitudinal section of entire joint. F femur T tibia P patella. S joint cavity between femur and patella. Joint is preserved. The tibia and femur are united by mass of dense fibrous tissue (N).

Fig. 8 Experiment N. 8 Partial excision of knee joint radiogram 64 days after operation. There is apparently bony ankylosis.

Fig. 9 Experiment N. 8 Partial excision of knee joint 86 days. Longitudinal section of entire joint. F femur T tibia. The bones are joined by mass of dense fibrous tissue.

was complete obliteration of the joint cavity except at posterior margin, where a small piece of cartilage remained.

**Microscopical study.** The cartilage has been completely removed from the femur and patella; some cartilage remains at posterior margin of the tibial joint surface (Fig. 15). The denuded bones are joined by a mass of newly formed fibrous tissue which is growing

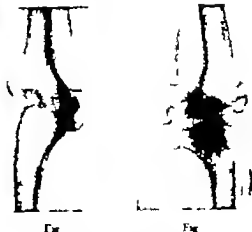


Fig. 5 Experiment N. 5 Partial excision of knee joint radiogram 4 days after operation. Note the close approximation of the ends of the femur and the tibia, and the absence of union by bone.

Fig. 5 Experiment N. 5 Partial excision of the knee joint radiogram 80 days after operation. There is an osseous ankylosis.

from the marrow spaces of the cancellous bone. There are a few areas of old blood-clots which are being invaded by proliferative blood vessels and fibroblasts (Fig. 16). There is no new bone formed from the epiphysis. In striking contrast there is a well-marked area of subperiosteal new bone formation on the anterior surface of the femoral diaphysis (Fig. 12).

**Experiment No. 22.** Destruction of joint cartilage limited to anterior surface of femur and under surface of the patella. Third day. Entire leg swollen plaster dressing changed. Seventh day. Leg still swollen plaster dressing removed. Twelfth day. Purulent discharge from wound animal in good condition. Eighteenth day. Wound closed discharge has ceased. Thirty fifth day. Wound entirely healed limb held flexed passive motion free. Forty eighth day. Animal in good condition passive motion limited. Three hundred and thirty fourth day. Animal in good condition sacrificed. There is slight motion between femur and tibia the patella is fixed. Joint removed microscopical sections prepared.

**Microscopical study.** Median section through the joint shows entire obliteration of the space between the patella and its tendon and the anterior surface of the femoral

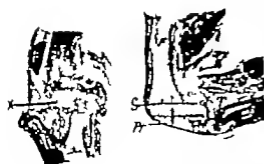


Fig 3

Fig 3 Experiment No 3 Partial excision of knee-joint, 9 days. Median longitudinal section of entire joint. P, patella; F, femur; T, tibia. The tissue X, between the ends of the bones is new formed connective tissue. No new bone formation.



Fig 4

Fig 4 Experiment No 4 Partial excision of the knee-joint, 30 days. Longitudinal section through the internal condyle of the femur. P, patella; F, femur; T, tibia. The ends of the femur and tibia are not in apposition. The lower end of the femur is adherent to the patellar tendon. Note that the lower end of the femur is straight line, which shows no new bone formation. Note also the irregular spaces between the femur and the tibia. See Fig 5.



Fig 5 Experiment No 4 Partial excision of knee-joint, 30 days. High power photomicrograph of the small space in the fibrous tissue between the femur and tibia indicated in Fig 4.

femoral condyles, and patella. The joint was closed with interrupted fine silk sutures. The hmb was held fixed in a plaster of Paris dressing.

Experiment No 15 Destruction of joint cartilage. Fifth day. Animal in good condition. Eleventh day. Animal has cough and nasal discharge. Sacrificed. Plaster dressing removed. Healing *per primam*. Joint removed. Fixed in formalin. After decalcification the joint was sectioned longitudinally. The joint cavity was entirely obliterated by granulation tissue, except for a small articular space between the patella and the anterior femoral surface. There is no gross evidence of new bone formation.

Microscopical study. Between the denuded bones there is a mass of fibrin, which contains numerous small fragments of bone. From the marrow there is an active proliferation of new blood vessels and fibroblasts. No new formed bone (Fig 4).

Experiment No 14 Destruction of joint cartilage. Fifth day. Animal in good condition. Eleventh day. Plaster dressing in good shape. Animal has lost weight. Twenty first day. Animal found dead. Cause not discovered. Joint removed. After decalcification the joint was sectioned longitudinally. There

At the end of six days (Experiment No 10) the apposed bones were united by a fibrous exudate into which is growing granulation tissue from the bone marrow. At the end of nineteen days (Experiment No 3) the bones are united by connective tissue. In Experiments Nos 4, 8 and 2 of fifty, sixty-four and eighty-six days respectively the connective tissue uniting the bones became progressively more fibrous in character. At the end of one hundred and forty-six days (Experiment No 7) the fibrous ankylosis was being changed into an osseous ankylosis by a direct transformation of the fibrous tissue into bone. In Experiment No 5 after one hundred and eighty days with close approximation of the bone surfaces the ankylosis was by bone.

## II DESTRUCTION OF JOINT-CARTILAGE

The knee joint was opened by a lateral longitudinal incision. The patella and its tendon were displaced medialward. The semilunar cartilages were removed from the head of the tibia, and the joint-cartilage was curetted from the joint surfaces of the tibia.

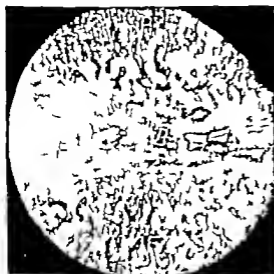


Fig. 6 Experiment No. 14 Destruction of joint 20 days. Photomicrograph of junction of the patella and femur. P, cancellous bone of patella; F, cancellous bone of femur. The two bones are adherent by fibrous strands at B. X, which has been replaced by fibrous tissue at X. Note the complete absence of new bone formation.

areas of cartilage were removed from the inferior surfaces of the femoral condyles and from the outer surface of the tibial head. The joint was closed as usual. No plaster of Paris dressing was applied. Eighth day. Operative wound healed *per primam*. Knee slightly swollen, not tender. Animal in good condition. Passive motion of 45 degrees allowed. Fortieth day. Animal found dead. Autopsy shows bronchopneumonia. Knee removed. Microscopical preparations made.

**Microscopical study.** Longitudinal section through the outer femoral condyle and tibia shows that the cartilage was destroyed in areas of 1 cm diameter on the femoral and tibial surfaces. The two denuded areas are not in apposition. Overlying these denuded areas is an old fibrous exudate which is being replaced by granulation tissue from the marrow. In the marrow in the regions of these injuries there is an active production of granulation tissue which is absorbing the cartilage from below. The synovial membrane shows a marked thickening due to proliferation of the endothelial cells and infiltration by small round-cells.

Experiment No. 27. Knee-joint opened in



Fig. 7 Experiment No. 27 Destruction of joint cartilage 334 days. Medial longitudinal section through entire joint. F, femur; T, tibia; P, patella. The patella is adherent to the femur by a mass of dense fibrous tissue (X) which is becoming ossified. See Fig. 5.

the usual manner and patella fractured transversely. Wound closed, no plaster of Paris bandage applied. Wound healed *per primam*. Animal used limb with no disability. Three hundred and sixty-fifth day. Animal sacrificed. Passive motion gives slight crepitus. Joint opened, no excess of free fluid. Fracture has healed to linear scar. Extending across the joint cavity in various directions are translucent fibrous bands. The cartilage on the tibia, on the inferior surface of the condyles, and in the intercondylar groove seems normal. On the lateral medial and superior margins of the cartilage on the femur there is a marked change in the cartilage. It appears much thinned or replaced by fibrous tissue.

**Microscopical study.** Medial longitudinal section shows normal cartilage except at the upper margin of the femoral surface. Here the cartilage is entirely destroyed, the cancellous bone being covered by a layer of fibrous tissue. The synovial membrane is thickened and shows an infiltration of small round cells. There are numerous villi which are seen especially around the margins of the cartilage.

**Summary.** In these experiments the injury to the joint-cartilage was comparatively slight.



Fig. 3 Experiment No. 5. Partial eversion of the knee joint, 30 days after operation. Medial longitudinal section of the joint. F, femur; T, tibia; P, patella. The cancellous bone of the tibia and femur is continuous.

condyles. There are a few small slitlike cavities between the femur and the tibia. There is a small portion of the femoral joint-cartilage remaining on the posterior margin of the femoral condyles. On the tibia the cartilage has undergone a fibrous transformation. Between the patella and the femur there is a mass of dense fibrous tissue which contains numerous large blood spaces (Fig. 17). At the junction of the bone and this fibrous tissue there are areas that show a gradual transition between bone and fibrous tissue, so that it cannot be said where bone and fibrous tissue begin and end. The fibrous tissue near the margins of the actual bone shows a remarkable architectural appearance in that the arrangement of the connective-tissue fibers and cells is in the form of a whorl around blood spaces, similar to the structure of cortical bone. There is no new bone formation in the sense of cartilage destruction and replacement by bone formed by osteoblasts; but there is a metaplasia of the



Fig. 14

Fig. 5

Fig. 14 Experiment No. 5. Destruction of joint cartilage 21 days. Longitudinal section of entire joint. F, femur; T, tibia. The joint cartilage has been completely removed from the femur. The joint cavity between the femur and the joint capsule has been completely obliterated by granulation tissue. The space S is tear in the section.

Fig. 5 Experiment No. 23. Destruction of joint cartilage 45 days. Medial longitudinal section of entire joint. F, femur; T, tibia; P, patella. The joint cartilage has been entirely removed from the femur and patella. Note the complete obliteration of the joint cavity. See Fig. 18.

fibrous tissue into fibrocartilaginous tissue followed by a direct transformation into bone. The new bone formed in this process has the architecture of cortical rather than of cancellous bone (Fig. 18).

**SUMMARY.** In these experiments in which the articular cartilage was destroyed the condition produced was essentially the same as that in which partial eversion was done, except that the normal contour of the bones was unchanged. This condition is the same as that which follows a surgical operation for the mobilization of an ankylosis in which the bones have retained their normal shape—such as is found in fibrous ankylosis.

These experiments show that after destruction of joint cartilage there is union of the joint surfaces by connective tissue which is transformed into bone only after a relatively long time.

In Experiment No. 22 actual union by bone was not complete at the end of 354 days.

### III. INJURY TO JOINT CARTILAGE

Experiment No. 23. Knee-joint opened in the usual manner. With a curette small



Fig. 9

Fig. 20

Fig.

Fig.

Fig. 9. Experiment N. 9. Infection of joint cavity 4 days. Cross section of one condyle and half of patella. F femur, P patella, E fibrocartilagenous cord. The site of the joint between the condyle and capsule. With the organization of such an exudate the joint cavity is diminished by the attachment of the joint capsule at the point B rather than its normal attachment at A.

Fig. 20. Experiment No. 9. Infection of joint cavity 4 days. Photomicrograph to show the marked proliferative process in the synovium. S joint cavity, X synovium.

Fig. Experiment N. 9. Infection of joint cavity

4 days. Photomicrograph of the posterior margin of the joint cartilage in the intracondylar groove. S joint cavity, C cartilage. At the junction of the synovium and the cartilage note marked proliferation of the synovial endothelium and the beginning destruction of the cartilage at D.

Fig. Experiment N. 9. Infection joint cavity 4 days. Photomicrograph of the line of union of the joint cartilage and the cancellous bone of the epiphysis. C cartilage, B cancellous tissue, A indicates small nodular growths of granulating tissue invading the cartilage

and gelatinous. Culture taken from this fluid grew staphylococcus aureus. At the margin of the cartilage on the internal condyle there is an irregular erosion about 0.5 cm. in diameter the margins of which were intensely injected. Around the margin of the patella there was erosion of the cartilage. The patella tendon was joined to the anterior surface of the femur by a band of friable translucent oedematous granulation tissue. The capsule

joint. Fifth day. Animal in good condition. Knee swollen and tender, motion limited. Fourteenth day. Animal in fair condition. Knee joint hot and tender, fluid in joint, motion limited. Seventeenth day. Dog has lost weight, knee thickened, not so tender, uses limb slightly in walking. Twenty-first day. Animal has sore eyes, sacrificed. The knee is thickened. Joint opened. There is a light excess of joint fluid which is cloudy



Fig. 8. Experiment No. 23. Destruction of joint cartilage 334 days. Photomicrograph of the junction of the bone and fibrous tissue indicated (C) in Fig. 7. The picture shows well-developed bone at B and dense fibrous tissue at A. Between these there is cone (C) in which the fibrous tissue is being converted directly into bone.

In Experiment No. 23 fourteen days after the destruction of a small area of joint cartilage there was an inflammatory process in the joint which was destroying the cartilage in a manner exactly similar to that which follows infection of the joint cavity. In Experiment No. 27 in which the joint injury was limited to a transverse patellar fracture, there were after three hundred and sixty five days definite pathological changes in the joint cartilage and synovial membrane.

#### IV. DIRECT INFECTION OF NORMAL JOINTS

In these experiments the organisms were injected directly into the knee joint cavity with an hypodermic syringe. The organisms used were a staphylococcus aureus, obtained from a fatal case of pyemia in man, and a bacillus tuberculosis of the human type which had been grown in the laboratory for several years. Of the staphylococcus aureus, twenty four hour broth cultures were used for injection. Of the tubercle bacilli one month glycerine agar cultures were suspended in normal salt solution.

Experiment No. 19. Injection of 2.5 ccm. broth-culture staphylococcus aureus into knee-

joint cavity. Second day. Animal in good condition. Knee swollen, tender and hot. Third day. Animal sick. Knee swollen and tender. Fourth day. Animal dead. Autopsy shows extensive consolidation of the lung with miliary abscesses. Joint removed when opened the capsule was adherent in several places to the lateral and medial sides of the condyles. There is no beginning cartilage destruction about the margins of the cartilage. Microscopical preparations made.

*Microscopical study.* A transverse section of the condyles (Fig. 19) shows the capsule adherent to the lateral surface of the condyle by inflammatory exudate, obliterating the greater part of the lateral joint cavity. A median longitudinal section shows the cartilage intact, except at the margins of the patella and at the posterior margin of the cartilage on the femur. Here there are small areas of infiltration with leucocytes, some necrosis, and a fibrinous exudate (Fig. 21). The cancellous bone of the condyles and patella appears normal. Extending from the marrow into the under surface of the joint cartilage are numerous buds of inflammatory tissue (Fig. 22) containing a large number of leucocytes. The free surface of the cartilage is strikingly regular in outline. In some areas the cartilage nuclei nearest the joint surface have lost their staining properties, and the matrix is more opaque and takes a deeper eosin stain. Over such areas there is a thin layer of adherent fibrinous exudate. There is a very active proliferation of the synovial endothelium (Fig. 20).

Experiment No. 17. Injection 2.5 ccm. broth culture of staphylococcus aureus into knee-joint. Second day. Animal in good condition. Knee swollen, tender and hot. Third day. Local heat and swelling, motions of knee guarded. Thirteenth day. Animal found dead, cause not discovered. Knee-joint removed and opened by lateral incision. There are areas of infection and ulceration about the edges of the cartilage. Cartilage elsewhere is normal in appearance. Joint contains no excess of free fluid. Microscopical study not made.

Experiment No. 13. Injection 2 ccm. broth culture of staphylococcus aureus into knee-

# ARTERIOVENOUS (VARICOSE) ANEURISM OF THE DEEP EPIGASTRIC ARTERY AND VEIN<sup>1</sup>

REPORT OF A UNIQUE CASE WITH A REVIEW OF THE LITERATURE

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**DEFINITION** Arteriovenous aneurism is an abnormal communication between an artery and a vein, through which blood circulates. There are two varieties of arteriovenous aneurism: (1) The *aneurismal varix* in which there is a direct communication between the artery and the vein; (2) the *varicose aneurism* in which the artery and the vein communicate through an intermediate sac.

In the most simple form there is merely an arteriovenous fistula, although usually the vessels about the aneurism are more or less dilated (Fig. 1). Then there may be besides this fistula, a sacculated artery (Fig. 2), a sacculated vein (Fig. 3), an intermediate sac (Fig. 4), or a combination of these conditions (Figs. 4, 5 and 6). It is more common to find the vein sacculated than the artery.

**History** It is an error to credit Sennert with the discovery of arteriovenous aneurism, for although this author was the first to record the exact symptoms of the lesion, he believed and maintained that it was the ordinary aneurism he was describing. Clinically the history of this remarkable discovery begins with the first accurately recorded case by William Hunter in 1757, who established the existence of arteriovenous aneurism without autopsy simply by carefully analyzing the symptoms, *Le Dentu et Delbet* (1).

Delacombe, in 1761, published an anatomical description of arteriovenous aneurism based upon the post mortem study of a lesion implicating the femoral vessels, *Broca* (2).

The first scientific account of arteriovenous aneurism of the subclavian vessels dates back to the classical case of Sargent Pierre CaDrioux, whose injury was treated by the distinguished Dominique J. Larrey (3) in 1829 and made memorable by his admirable paper in the "*Cliniques Chirurgicales*," Paris, 1829.

**Etiology** Arteriovenous aneurism arises most frequently as the result of an injury which opens an artery and a vein at the same time. In the days of venesection, the unskillful use of the lancet frequently caused the simultaneous incisional injury of the brachial artery and the median basilic vein, thus producing an arteriovenous aneurism. At the present time it is less common in this location, but is occasionally found in such regions as the neck, axilla, groin and the extremities. Bullet and stab wounds are the usual causes. Cases are on record in which an arterial aneurism has ruptured into a vein, thus producing an abnormal communication between the two vessels. In others, it appears that the aneurism has occurred spontaneously in diseased arterial and venous walls, *Johnson* (4).

Fractures are known to have caused arteriovenous aneurism at the base of the skull, bone fragments wounding simultaneously the internal carotid artery and the cavernous sinus. The spontaneous variety generally occurs in the aorta, sometimes the communication is with the pulmonary vein, or in case the abdominal aorta is affected, with the inferior vena cava.

*Alatas* (5) in 1901 made an analytic study of fifteen cases of arteriovenous aneurism of the subclavian vessels, including one of his own. These cases were collected from all sources of the literature. They were all of traumatic origin, nine were caused by stab or penetrating cut wounds, the other six by bullet wounds. All the cases were in men, none exceeding the middle age.

**Pathology** The inception of arteriovenous aneurism usually is traceable to "first aid" treatment, i. e. to the firmly laid compress over the causative wound placed for the purpose of arresting hemorrhage. In the healing of such a wound the inflammatory reaction causes the vessels to adhere to each



Fig. 23 Experiment No. 3 Infection of joint on 17 days. Photomicrograph shows destruction of cartilage by granulation tissue from its back surface. There is a distance from the actual ulceration of the cartilage. Not that the cartilage (C) is separated from the cancellous bone (B) by areas of granulation tissue (A). At this stage the cartilage can be readily lifted off the bone.

is everywhere edematous. Microscopical sections prepared.

**Microscopical study.** There is a fibropurulent exudate in the joint cavity. The quadriceps tendon is adherent to the anterior surface of the femur. The surface of the joint-cartilage of the femur is normal except for the margin where there is everywhere a beginning cartilage destruction and at a point on the medial condyle there is complete destruction over an area of 0.5 cm. in diameter (Fig. 24). The cartilage on the patella and tibia shows a similar condition. The under surface of the cartilage shows a strikingly abnormal picture. There is a narrow zone in the cancellous bone immediately under the cartilage in which there is a marked decrease in the lymphoid cells with numerous proliferating blood vessels, fibroblasts, and leucocytes. From this zone of granulation tissue there extends into the cartilage numerous budlike processes. The bone trabeculae show evidence of destruction (Fig. 23). The synovial membrane shows marked proliferation of large pale endothelial-like cells which form villi extending into the joint cavity.

Experiment No. 12. Injection 1 cc. broth culture of staphylococcus aureus into knee joint. Fifth day. Knee slightly swollen and



Fig. 24 Experiment No. 3 Infection of joint, 21 days. Longitudinal section through medial condyle of femur. T shows the ulceration of the cartilage at X (see Figs. 3, 23).

tender animal in good condition. Fourteenth day. Animal used limb with slight limp, no swelling or heat. Seventeenth day. Animal uses limb normally. Injection 4 cc. broth culture of staphylococcus aureus. Twenty-first day. Limb held flexed, slightly swollen and tender. Twenty-eighth day. Animal in good condition, joint slightly hot and tender, extension limited. Injection 2.5 cc. staphylococcus aureus broth culture. Twenty-ninth day. Knee swollen, fluctuates, animal in good condition. Forty-first day. Dog in good condition, no local heat or swelling. Injection of 2 cc. of broth culture of staphylococcus aureus. Forty-fourth day. Animal in good condition, joint swollen, tender, not used. Fifty-fourth day. Animal holds knee flexed, no heat or swelling. Injection of 2.5 cc. broth culture staphylococcus aureus. Sixty-second day. Animal in good condition, no swelling or tenderness. Animal sacrificed. On opening the knee joint there was 3 to 4 cc. of a thick cloudy fluid. About the margin of the patella is a narrow zone of villous granulation. At the superior margin of the femoral cartilage there is an area of destruction. About the insertion of the capsule there are numerous polypike granulations. The central portions of the joint cartilage are not normal.

Experiment No. 1. Injection 1 cc. broth culture staphylococcus aureus into knee-

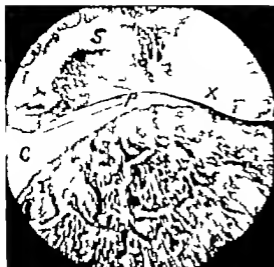


Fig. 5 Experiment No. 3 Infection of joint, 5 days. Photomicrograph of margin of ulceration of cartilage. S joint cavity. The cartilage is completely destroyed at X. Note the notching of the cartilage from its under surface at P. Also that the joint surface of the cartilage remains quite smooth.

joint cavity. Fifth day. Knee slightly swollen. Animal uses leg in walking. On the 17th, 28th, 41st, 56th, and 64th days this animal received 1 ccm of broth culture of staphylococcus aureus in the knee-joint. With each infection there was only a slight local reaction. One hundredth day. Animal walks on limb with slight limp. Knee allows a free passive motion. Animal sacrificed. On opening the joint there is a small amount of thick mucous like fluid. There are no adhesions in the joint. About the patella surface there is a zone of villi which when depressed show the cartilage to be undermined. About the periphery the femoral cartilage is roughened and has the appearance of fibrous tissue. The joint capsule is reflected from the anterior surface of the femur at a lower level than normal. About the insertion of the cruciform ligaments there is a change in the cartilage similar to that seen at the patella margin.

*Microscopical study.* Sections were cut from the patella, femur and tibia. The synovial membrane thickened. There are numerous villi extending into the joint. The joint surface of the cartilage is normal except at the junction of the cartilage and the synovial



Fig. 6 Experiment No. 3 Infection joint cavity, 5 days. Photomicrograph to show almost complete cartilage destruction. S, joint cavity. C, small remnants of joint cartilage. B, spicule of cancellous bone. G, granulation tissue.

membrane where there is destruction of cartilage by granulation tissue. Extending from the epiphyseal marrow spaces into the under surface of the cartilage are numerous processes of granulation tissue.

Experiment No. 29. Injection 1 ccm of a suspension of tubercle bacilli into the knee joint cavity. Fifth day. Animal in good condition. Knee swollen, tender and hot. Motion is limited. Twelfth day. Animal has lost weight. Knee is held flexed, is hot and tender. Sixteenth day. Animal sacrificed. On opening the joint there was no excess of free fluid. The joint-capsule was thickened and adherent to the sides of the femoral condyles by a mass of granulation tissue. The synovial surface was partly covered by irregular areas of red translucent tissue in which there were numerous small nodular elevations. The cartilage over the patella was normal. About the margin of the patella was a zone of granulation tissue. There were no adhesions between the femur and the patella. The lateral surface of the external condyle was denuded of cartilage almost to the edge of the patellar groove. There is destruction of cartilage in the intercondylar groove about the insertion of the cruciform ligaments. The space between the femur and tibia is filled with granulation tissue.

*Microscopical study.* Sections were cut from the patella, femur and tibia. The

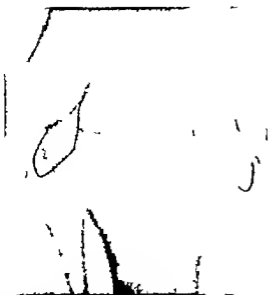


Fig. 27. Reaction of the knee joint in man (thirteen months after operation). Note that there is no bony ankylosis. There is no motion at the knee.

synovial membrane is markedly thickened and shows an infiltration with lymphocytes and polymorphonuclear leucocytes. The joint cartilage is normal except at its margins, where there is cartilage destruction. The bone-marrow of the epiphysis shows a very little inflammatory reaction. There are a few areas in which granulation tissue is invading the cartilage from beneath. On the anterior surface of the patella is a small nodule of new formed bone. There is no tubercle formation.

Experiment No. 20. Injection 2 ccm staphylococcus aureus into knee joint cavity. Eleventh day. Joint not swollen slightly tender. Lamb not used in walking. Animal in good condition. Thirteenth day. Injected 2 ccm of tubercle bacillus suspension into same knee-joint cavity. Seventeenth day. Knee slightly tender, slight heat, not used in walking. Twenty-fifth day. Animal in good condition. Knee held flexed, slightly tender. Thirty-second day. Knee thickened, tender and hot, not used and is held in acute flexion. Eightieth day. Lamb held in right-angle flexion. Joint thickened, allows little motion. Animal sacrificed.



Fig. 28. Reaction of the knee joint in man (three years after operation). Note the union of bone.

*Microscopical study.* Median longitudinal sections show the synovial membrane to be tremendously thickened. The joint cavity is much decreased in size. The joint cartilage shows destructive changes throughout. The cartilage of the internal condyle is completely destroyed. This destruction is brought about by granulation tissue invading the cartilage from beneath and from the synovial membrane at its margins. In some cases the granulation tissue from the synovial membrane extends over the cartilage for a considerable distance. There is no tubercle formation.

*Summary.* In these experiments, in which bacteria were introduced directly into the joint cavity, characteristic pathological changes resulted. The joint changes in the experiments in which tubercle bacilli were used were the same as those observed in the experiments in which the staphylococcus was used. The extent of the joint changes and the general reaction to the infection varied widely in the different experiments.

Immediately after the introduction of the infectious agent into the joint cavity there

was a marked local reaction evidenced by swelling, heat, and tenderness. There was a fibropurulent exudate in the joint cavity, which produced adhesions between the capsule and the condyles, resulting in a marked diminution in the size of the joint cavity. The destruction of the joint-cartilage was always the result of absorption by granulation tissue. Granulation tissue arising from the proliferating synovial membrane destroyed the cartilage at its margin, and granulation tissue from the bone-marrow destroyed the cartilage from below.

#### GENERAL SUMMARY

From the experiments in which the joint cavity was infected with tubercle bacilli or staphylococci, or in which a slight injury was done the joint-cartilage, we are led to believe that any inflammatory process within a joint, which is of sufficient severity to result in the formation of granulation tissue will destroy the joint-cartilages. The cartilage is absorbed at its margin by granulation tissue from the synovial membrane and at its base by granulation tissue from the bone-marrow.

By the experiments in which the cartilage was removed by operation or the joint partly excised, we have shown that ankylosis by bone is a slowly developing process which consists of the following stages: *First* there is union by granulation tissue; *second* there is union by dense fibrous tissue; *third* there is a metaplasia of fibrous tissue into fibrocartilage and a direct transformation of this tissue into bone. The shortest period of time in which

complete bony ankylosis was observed experimentally was one hundred and eighty days. That in man the duration of the process is equally prolonged is shown in Figs. 27 and 28.

The long duration of the process of osseous ankylosis, we believe, explains the following: After arthroplasty a joint may allow motion for some weeks and subsequently become stiff. Fractures of the epiphysis unite by bone slowly. It also suggests that the conclusion reached by certain investigators that the interposition of soft parts prevents bony ankylosis is misleading in that many of the experiments were of insufficient duration.

The long duration of the fibrous stage of ankylosis also shows conclusively that any method of arthroplasty should have as its object the prevention of fibrous ankylosis rather than bony ankylosis, also that the insertion of an irritative substance into a joint should be avoided.

We believe that the difference which exists between the epiphysis and diaphysis in the capacity for bone regeneration is explained by the fact that there is no periosteum on the epiphysis.

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## IS THROMBO-ANGITIS OBLITERANS AN INFECTIOUS DISEASE?

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SINCE 1904 I have been collecting pathological material and clinical data on that interesting group of cases of pre-senile gangrene which have been described by the German under the name *endarteritis obliterans* and for which in May, 1908, before the Association of American Physicians, I proposed the term *thrombo-angitis obliterans*. At that time my deductions were based on a study of the vessels in nineteen amputated limbs. But today I am able to draw my conclusion from a much larger number, namely, forty amputated limbs (twenty amputated forearms) and some twenty-five extirpated veins from eighteen cases of thrombo-angitis afflicted with migrating phlebitis of the superficial veins.

With the rapid increase in the Jewish population of the city of New York during the last decade has come the opportunity of studying a disease which curiously enough seems to afflict this race almost exclusively and particularly the immigrant or children of immigrants from Poland, Russia and Rumania. During the last eight years some two hundred cases have come under my observation. This large number seen mostly in hospital and consultation practice peaks eloquently for the frequency of its occurrence and for the importance of discovering the causal agent.

It would be superfluous to present a record of all those facts and observations that have been gathered by me from this large amount of material. I wish merely to call attention to the conclusions that I regard as significant from the standpoint of pathology and biology. These may be briefly summarized in the statement that, in the light of clinical and pathological studies, we are warranted in thoroughly supporting the proposition that thrombo-angitis obliterans is an infectious disease in which a specific type of organism is at work and although it has not as yet been possible to demonstrate either bacteriologi-

cally or morphologically the presence of the offending agent the pathological findings clearly indicate whither future studies should be directed in order that the causal factor may be discovered.

In order that the argument in favor of such a revolutionary view may be followed, it may be well to review briefly the conclusions reached in some of my earlier studies. In May, 1908 I maintained that the pathological pictures could be explained upon the theory that we were dealing with extensive thrombosis in arteries and veins followed by organization and canalization and that the lesions in the vessel might be summarized as follows: Most of the larger arteries, and sometimes the veins as well, are obliterated over a large extent of their course. All stages in the occlusive change may occur in the various vessels of an extremity or in the same vessel in different part of its course. The closure of the vessels is effected by red organizing thrombi, these become organized, vascularized and canalized. Recent red thromboses may involve large portions of arteries or veins and is not secondary to the gangrenous process. It occurs even when no gangrene is present. In short we are dealing with lesions of considerable extent, apparently initiated by the formation of occlusive thrombi, chiefly in arteries, but not confined to these followed by organization or healing with a resultant production of sufficient collateral circulation.

As for the cause of the thromboses, my studies failed to reveal anything suggestive. The finding, however, of a peculiar type of histological picture in certain of the veins and arteries led me to believe that the same determining cause which leads to the thrombosis also evokes the changes in the media adventitia and perivascular connective tissue and further that although the mechanical conditions that obtain in the lower extremities and the arterio-sclerotic changes



Fig. 1. Old type of occlusion in deep vein lumen occupied by vascularized dense connective tissue.

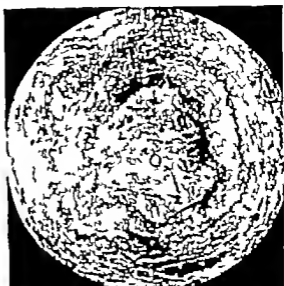


Fig. 2. Popliteal artery occluded by a sclerosed connective tissue, pigment small vessels, and capillaries being features.

may be factors some additional agent, be it toxic or otherwise is at the same time responsible for the production of the periarteritis and the thrombosis.

Unfortunately we are dealing with the vessel obtained by amputation and it is extremely difficult to obtain material in the early or acute stages of the disease. When limbs are amputated, the disease is usually of long duration and the arteries and veins are already in the stage of organization. The presence of the acute and specific picture in two of the cases however was so suggestive as to lead to the supposition that here was the lesion in its earliest stage.

It was most gratifying therefore to learn that the subcutaneous veins of the upper and lower extremities may also be affected by the same disease. When in the course of the observation the association of migrating phlebitis of the superficial veins with the symptom complex characteristic of the occlusion of the deep vessels was first noted it appeared of no little moment to determine whether the newly discovered phenomenon was not manifestation of the same malady. Collecting these cases I was able to report in 1909 eleven patients who at one time or

another in the course of the disease had suffered from thrombophlebitis involving the superficial veins of either the upper or lower extremities. From these investigations the following conclusions seemed warranted:

1. The disease thrombo angitis obliterans is often associated with thrombophlebitis of superficial veins of the arms and legs.

2. Certain peculiar cutaneous nodosities are characteristic manifestations in many of the cases.

3. The disease of the superficial veins may be subsidiary or it may dominate the clinical picture. Objective signs referable to these vessels should be regarded as extremely suspicious marks of the synchronous development of thrombo angitis obliterans. In the presence of migrating phlebitis or cutaneous nodosities we should carefully search for evidence of thrombo angitis obliterans in the form of pulseless vessels, erythromelia, blanching of the leg in the elevated posture, cold and blue toes, pain in the calf of the leg brought on by walking and other typical phenomena.

4. Migrating thrombophlebitis may give no symptom the sign referable to the deep vessel being of most importance.

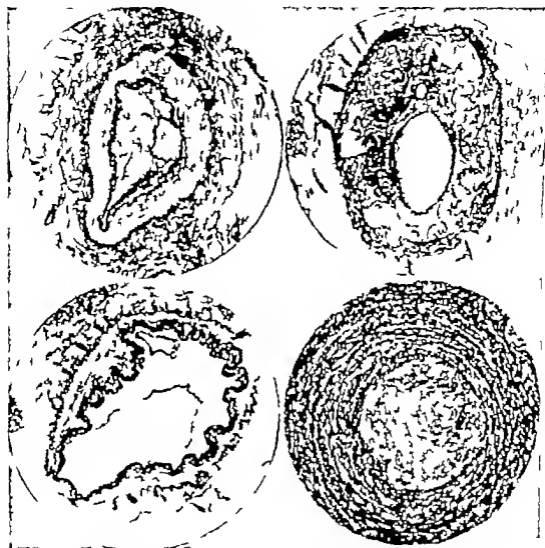


Fig. 3

Fig. 5

Fig. 4

Fig. 6

Fig. 3 Old occlusion of the fenestrated or cribriform type. Large caseating crust as fairly dense connective tissue filling the lumen of an artery.

Fig. 4 Old occlusion in artery simulating endarteritis obliterans. Eccentrically attached large caseating crust (below) crossing rest of tissue to one side (above is the ulceration).

Fig. 5 New lumen found in organized clot in vein simulating endarteritis obliterans (elastic tissue stain).

Fig. 6 Acute early lesion with solitary giant cell foci in periphery of clot filling lumen of deep vein.

5. Patients may suffer at one time from the migrating thrombophlebitis at another from the progress of occlusive change in the deeper vessels.

6. Certain cases suggest the possibility that attacks of trouble in surface veins may

occur simultaneously with similar exacerbations of disease in deep vessels of another limb.

7. The morbid process resulting in the production of cutaneous nodosities and thrombosed superficial veins is independent of

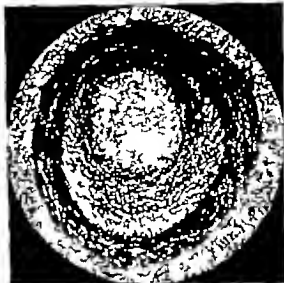


Fig. 7 Giant-cell focus of daughter cannulating vessel in obliterating artery, acute exacerbation in cannulating vessel.

Fig. 8 Acute lesion in arterial sphincters seen above, perivascular focus below, surrounding crescentic portion of lumen filled with organizing clot.

varicose veins of infections, or of trophic disorders in the territory which they drain.

8 The vessels of the upper extremity may be affected by the lesion thrombo-angitis obliterans.

9 Thrombophlebitis in the arm and forearm should arouse our suspicions as regards involvement of the deep vessels of the legs.

10 Further studies should be directed toward solving the relationship between the two thrombotic lesions we have described.

Since 1909 I have been able to gather data on twelve additional cases in which the superficial vein were involved and have brought the number of affected veins to twenty-five. In these both the acute and healed stages of the disease were found. From

scrutiny of the pathological picture the conclusion was reached that a specific character in the lesion of thrombo-angitis obliterans may affect the deep as well as the superficial vessel, and that it is different from the lesions in the extremities we have been able to gain a new material for investigation of the causative agent.

It is the purpose of demonstrating the sequence of the next stages of the pathological process in its earliest of terminal stage up to the healed or obliterated inactive

tissue stage, and in order to make clear the arguments in favor of my theory, it seems best to present a few selected histological pictures in the way of illustration. In these I shall endeavor to point out the general appearances of the old lesions in the deep vessels, the acute type of lesion in the deep veins and arteries, the lesion as seen in the vein under the skin, and how these latter are identical with the lesions of thrombo-angitis obliterans, and finally why the findings point so suggestively to the presence of some microbial agent although none such has as yet been revealed.

Let us review the pathological changes in the obliterated vessel in the sequence in which we have met them in the course of our studies, beginning with the most common lesion in the healed stage, as it is encountered in the majority of the diseased vessel removed from an amputated arm or leg.

Such vessels be they arteries or veins are filled with connective tissue (Fig. 1) bearing numerous cannulating vessels (Fig. 2) often some pigment of blood origin not infrequently presenting a cribriform appearance in the freshly cut surface of a transverse section.

1. Lower, the blood vessels do not contain any blood. 2. Higher, the blood vessels do contain blood. 3. Higher, the blood vessels do contain blood. 4. Higher, the blood vessels do contain blood.

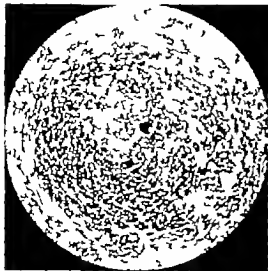


Fig 3. Acute lesion in superficial vein, media infiltrated giant-cell foci.

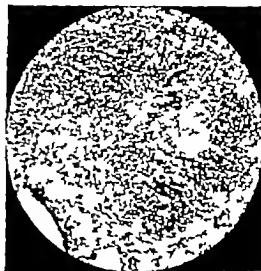


Fig 4. Later stage in acute lesion, simulating miliumary tubercle, endotheloid cells and giant cells surround log focus of disintegrating leucocytes.

(Fig 3) That the obliterating lesion should have been misinterpreted and regarded as an obliterative *endarteritis* is not surprising when we look at the pictures afforded by the artery seen in Fig 4 where a large canalizing vessel simulates a narrowed lumen and crowds the rest of the organized clot to one side. Such a vessel may be seen to divide. If its course be followed in serial sections, and the manner of its formation distinctly seen. In Fig 5 also there is a vein in which the picture of an *endarteritis* is mimicked.

All stages of the process, from the finished organized product back to the early thrombotic lesions where arteries and veins are filled with red clot were studied in the forty amputated legs and two amputated arms. For our purpose here it will suffice to call attention to the earliest or acute stage of the disease, as we were able to discover it in the vessels of but two of the forty amputated legs.

In many vessels the wall is diffusely infiltrated with leucocytes, more marked in some places than in others, and the lumen completely occluded by red clot in which certain characteristic foci, elsewhere referred to as miliumary giant cell foci, make a striking picture (Fig 6). When these were first encountered in our studies their significance

was not understood, except in so far as they seemed unique and specific for thrombo-angitis, not having been seen in thromboses due to other causes.

More recent investigations have clarified our notions, so that to-day a satisfactory explanation can be given for these very peculiar and seemingly specific morphological alterations. A change even earlier than this was sometimes found in the deep vessels, namely foci of pus cells in the periphery of the red clot, such areas being the precursors of the miliumary giant-cell foci that resemble miliumary tubercles. The suspicion that we were dealing with some specific microbial process was already aroused when the peculiar appearances in deep vessels were noted not only because such changes had never been seen elsewhere but also because the typical foci could even be discovered in daughter canalizing vessels of arteries that were already in the healing stage. Fig 7 shows such a specific focus taken from a canalizing vessel that was evidently the seat of an exacerbation or recrudescence of the disease thrombo-angitis obliterans.

Bilateral, however whose source is confined to amputated members must needs

be difficult to obtain, for seldom will it be our fortune to see the early lesions. Amputation is naturally only considered after the disease has progressed for many months or even years, when the patients are suffering from the mechanical phenomena due to obstructed inadequate vessels rather than from the acute stage of the disease.

It was, therefore, a happy circumstance that the superficial subcutaneous veins of the arms and legs were found to be involved by what has elsewhere<sup>1</sup> been termed an associated migrating phlebitis. From this source we were able to obtain adequate material for the establishment of the facts that the veins under the skin may be the seat of thrombo-angiitis obliterans, that the acute type of lesion in the superficial veins gives a specific picture similar to that in the deep vessels, and that the development of the lesion in its incipient stages can be studied, enabling us to explain the production of those bizarre appearances heretofore so inexplicable in their nature.

Let us turn to Fig. 8 in which a tributary of the internal saphenous vein presents a purulent focus in a portion of the obliterating clot. The rest of the clot is composed of red cells, some white cells, and fibrin already in the process of organization by capillary ingrowth. The purulent focus can be seen to be invaded by leucocytes from the media and adventitia (Fig. 9) and certainly does not represent merely agglutinated leucocytes derived from the intravascular blood.

Such foci vary in size, and it can be definitely established that their growth occurs by virtue of the immigration of leucocytes. Next in the life history of the lesion comes an attempt at healing these suppurative areas and in this process are found those characteristic and peculiar pictures elsewhere called "miliary giant-cell foci." Evidently the microbial agent toxin or whatever it may be, is concentrated especially in these areas.

Here it is instrumental in attracting leucocytes into the formation of miliary abscesses, and it may exert a more protracted force or influence in preventing that orderly and typical organizing process that is so

characteristic and so well known. Instead of the rapid ingrowth of angioblasts with the production of young capillary sprouts, the vessel-forming cells (angioblasts) seem to lose their power of purposeful penetration into the suppurative areas—grow wild as it were, become distorted and atypical, and arrange themselves along the periphery of the foci in the form of cells that we recognize as endothelioid.<sup>2</sup> Often they can be seen penetrating for a considerable distance into the leucocytic focus—fraying out, never able, at this stage to produce capillaries. On the other hand they do frequently terminate in the production of the typical giant-cells. This is the earliest stage in the attempt at organizing or healing these miliary foci.

At the same time, the typical successful organizing process may be found going on in other parts of the lumen of a vessel. Thus in Fig. 8 the crescentic area adjacent to the miliary focus is occupied by red clot and fibrin, successfully and normally organized by angioblasts.

Later as the giant-cells arrange themselves about the periphery of the focus and penetrate it to a certain extent (Fig. 9) the leucocytes disintegrate and finally a tubercle-like formation (Fig. 10) is the result. The purulent products become absorbed and the focus becomes converted into connective tissue.

The giant cells and endothelioid cells are but the expression of abortive attempts on the part of the angioblasts at organizing or healing a focus which is infectious. The true purpose of the vessel-forming cell (angioblasts) at times so beautifully illustrated in other parts of the same vessel lumen, is thwarted.

Later all vestiges of the acute lesion disappear the occluding thrombus becomes converted into vascularized connective tissue, the leucocytes and wandering cells disappear from the media, adventitia and perivascular connective tissue, an obliterated, canalized, and adherent vessel being left as the final product.

Such, then, are the acute lesions in the veins. They bespeak the presence of a microbial agent that must be sought for in the peculiar characteristic foci previ-

described. Up to the present time all our attempts at detecting the causative agent have been futile.

*Spirochaeta tubercle bacilli* the ordinary pyogenic organisms, have been carefully looked for in cultures in microscopic sections, and by inoculation methods, without result. However the search must not be given up since but relatively little of the acute material has as yet been available for study.

Although in this rapid review of a subject which still presents so many mooted points for investigation it has been impossible to give all the details which support the theory advanced it is hoped that a vigorous plea in favor of the correctness of the following points has been made.

*First* that thrombo-angitis obliterans is a disease in which an acute inflammatory lesion and occlusive thrombosis of arteries and veins are the characteristic lesions.

*Second* that from the mechanical point of view and from the standpoint of symptoma-

tology the thrombotic occlusion is the most important phenomenon.

*Third* that the thrombosis is probably preceded and certainly accompanied, by an acute inflammatory or exudative stage.

*Fourth* that the lesion involves deep veins in about 40 per cent and the superficial veins of the upper and lower extremity in 20 per cent, of the cases.

*Fifth* that recent investigations of the veins show that the acute lesions in the superficial vessels and then deep vessels are identical.

*Sixth* that the histological changes in the veins point to the existence of an infectious process.

*Seventh* that we believe that future studies should be directed toward the discovery of the causative agent in specimens cut out from the superficial veins when they are the seat of the acute thrombophlebitis. In this way it is hoped that the etiology of the disease may soon become revealed.

## FORWARD FIXATION OF THE CERVIX AS A PREDISPOSING CAUSE OF SOME RETRODEVATIONS OF THE UTERUS AND AN OPERATION FOR ITS RELEASE

By EDWARD REYNOLDS, M. D. Boston

**P**ROGRESS in practical matters is usually inaugurated by prior work on the theoretical considerations which underlie it. This brief paper will therefore contain a statement of the views as to the support of the uterus which have guided me of late years, my conception of the anatomy of the abnormal condition which I believe is a predisposing cause in many cases of the retrodeviations, and a description of the operative procedure by which I am in the habit of correcting it. I feel bound however to say here that no one can be better aware than I am that under the limitations of time imposed upon us most of the statements which I am about to make are little more than personal assertions, nor indeed that my views are for the most part

merely the result of personal clinical observations which cannot be accepted by any one else as proof of their correctness. These observations have however extended over so long a period of time and have to the best of my belief been conducted in so skeptical a spirit i. e. with so consistent an effort at the attitude of scientific doubt, that I am personally very strongly convinced of their correctness. The practical results which have followed their adoption have moreover seemed to me to be so good that I am quite content to pursue the method in my personal work and am quite convinced that in the process of time they will prevail.

The uterus is sustained in its position in the pelvis by the resultant of the action of a great number of unstriated muscular fibers



other. The wound through the vessels does not heal however on account of the constant flow of blood through the openings. The arterial blood thus projected into the vein eventually dilates the latter. There is some alteration in the coats of the vessels but none that would offer restraint to the circulation of the blood as in arterial aneurism. The vein is generally dilated but not enough to cause rupture. The veins beyond the varix are nearly always more or less dilated and enlarged. Varicose aneurism usually forms when the wound causing the aneurism remains untreated or if the compress placed for arresting hæmorrhage does not exert sufficient pressure. In such cases blood will extravasate between the walls of the artery and the vein separating the two vessels. Inflammatory lymph deposited around the space will organize and a false aneurism is formed communicating with both vessels. The sac in such a case consists of condensed effused lymph. On account of the slight arterial pressure affecting the walls of the sac of a varicose aneurism, the sac, as a rule, is not subject to much enlargement. In an ordinary aneurism the force of the blood current impinges directly on the aneurismal sac but in the varicose aneurism the blood current finds its way through the aperture into the vein thus its force is distributed, instead of being directed against the walls of the sac. While enlargement of the sac is not common, yet in view of the liability of the sac to slough, and the danger of gangrene of the limb or of the false aneurism to become diffuse, the indication for surgical interference is plain.

*Diagnosis and symptoms.* The symptoms of varicose aneurism and of aneurismal varix are nearly identical, with the exception of the presence of the sac in the former. The sac can, in some cases, be recognized by palpation and by a soft bruit. The symptoms of arteriovenous aneurism vary according to the location and the relative size of the vessels involved. If the artery is small and the vein large so that the additional flow of blood can readily be disposed of the symptoms may be slight or entirely absent. If on the other hand the artery is large and the vein small the vein and its branches become enlarged

varicose and tortuous on the distal side of the abnormal opening and serious disturbances of circulation and nutrition may follow. The symptoms usually make their appearance early after the causative accident, characteristic signs are perceptible, a thrill can be felt and a murmur heard by placing the stethoscope over the opening between the artery and the vein. The murmur is continuous and likened to the purring of a kitten or the noise of the blue-bottle fly when buzzing in the interior of a thin paper bag. The intensity of the rhythm changes, corresponding to the pulsations of the heart. The blood as it enters the vein, comes in contact with the opposing venous stream and produces a whistling sound which is pathognomonic of aneurismal varix once heard this sound will never be forgotten nor mistaken for any other condition. The varicosity of the veins may increase and become so extensive as to involve most of the superficial veins of the extremities. There are sometimes disturbances of sensation in the limbs, such as numbness, tingling, and neuralgic pains. The nutrition may be altered, and there may be weakness of the muscles, oedema, dermatitis, and ulceration of the skin. Alakias (6) states that a striking symptom of both aneurismal varix and varicose aneurism is the accelerated heart action.

*Prognosis.* In some cases the disease is stationary in others, it grows worse. There is no recognized tendency to spontaneous cure in arteriovenous aneurism. Oedema is the rule. Rupture of the sac may occur. Muscular atrophy is common, and ulceration and even gangrene of the limb may supervene. Cases of spontaneous recovery however have been reported in the literature.

*Treatment.* Keeping in mind the tendency of varicose aneurism to ulcerate and become diffuse, radical treatment should not be delayed. Compression should not be practiced, as the already dilated sac and varicose veins would become more enlarged and finally cause a marked oedema and expose the patient to the danger of gangrene. The Hunterian operation of tying the femoral artery above the sac, in the healthy femur, has been tried in two cases, and death followed in both.

which are partly disseminated throughout the pelvic connective tissue and partly aggregated into bundles lying within reflections of the peritoneum which have long been falsely called uterine ligaments. The gynecological profession has been extremely slow in accepting this advance of knowledge in regard to the composition of the uterine ligaments, falsely so called but a search through the anatomical literature of the last ten years will convince any one that among anatomists this is standard knowledge and I think that no gynecologist can long watch the behavior of these tissues as he cuts through them during operation without becoming convinced of their retractile power i. e. of their muscular action. The chief bundles of such fiber are distributed along the course of the ovarian and uterine arteries to which we must add the round ligaments and it must not be forgotten that lesser quantities of unstripped muscular fiber are distributed throughout the entire body of the broad ligament.

My own observations during recent years have convinced me more and more strongly that study of the pathologic spasms of these muscular structures is opening up a whole new field in gynecology more especially in the relation of pelvic lesions to neurasthenia and the production of pain but a reference to this is not my present purpose which is the influence of these structures on the production and relief of the retrodeviations.

The uterus as a whole is then sustained by elastic (muscular) tissue and the cervix is the only part of it which is attached to the bones, or to the firm connective tissues over them by inelastic connective tissue this attachment being the extremely strong and unyielding anterior vaginal wall with its firm attachments to the pubic arch and the median Y-shaped ligament first described by Goffe which extended from the cervico-vaginal attachment to the connective tissue above the pubic arch on each side of the urethra.

The anomaly known as antelexion of the cervix is not separated by any sharp line from the normal slight forward curve of the organ cases being found in every degree of

variation from the normal, through the high normal and the slightly pathological, into the highest degree of antelexion. It is now generally conceded that this abnormality is an arrest of development but I think it is not generally understood that this arrest of development is never confined to the cervix alone but necessarily includes also a short anterior vaginal wall i. e. an underdevelopment of this firm structure and of Goffe's ligament by which the vaginal cervix is held in forward fixation close under the pubic arch.

This shortened attachment holds the vaginal portion of the antelexed cervix firmly forward, while the *supravaginal* cervix is at the same time steadied from side to side by the powerful muscular action of the lower portions of the broad ligaments along the uterine arteries and drawn backward by the almost equally powerful uterosacrales. The fundus in its turn is held forward by the disseminated muscular fibers in the upper parts of the broad ligaments and by the occasional action of the round ligaments. Such a uterus has an intrinsic angle in its shape situated at about the internal os but with the vaginal cervix fixed forward and with the fibers in the vicinity of the round ligaments drawing the fundus forward, the action of the muscular uterosacrales in drawing the middle of the organ back tends constantly to an exaggeration of this angle. With the onset of the catamenial congestion the uterine walls engorge with blood, and under primary hydrostatic laws the organ tends to resume its normal shape i. e. to efface any increase of angulation due to the action of these muscles. Under these conditions with the cervix fixed forward and with the uterus trying to straighten itself the fundus would of necessity turn backward were it not for the muscular action of the round ligaments and the unstripped fibers which accompany them. If then at any moment this action relaxes even temporarily the fundus must of necessity move backward that is, in other words, with the cervix, the lower pole of the organ, fixed forward to an abnormal degree, any straight

Underestimating these structures also, is the onset of the precatamenial congestion (and its increase the action of the pelvic muscles) and the result of these actions is not from backache and crampy dysmenorrhea, but, not only as pain, but also from the production of the retrodeviations.

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*Spirochæta tubercle bacilli* the ordinary pyogenic organism have been carefully looked for in cultures, in microscopic section and by inoculation methods without result. However the search must not be given up since but relatively little of the "acute" material has as yet been available for study.

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## FORWARD TILTING OF THE CERVIX AS A PREDISPOSING CAUSE OF SOME RETRODEVATIONS OF THE UTERUS AND AN OPERATION FOR ITS RELIEF.<sup>1</sup>

B. EDWARD REYNOLDS, M.D., B.S.

**P**ROGRESS in practical matters is usually inaugurated by prior work on the theoretical consideration which underlie it. This brief paper will therefore contain a statement of the views and the support of the uterus which have guided me of late years my conception of the anatomy of the abnormal condition which I believe is a predisposing cause in many cases of the retrodeviation and a description of the operative procedure by which I am in the habit of correcting it. I feel bound however to say here that no one can be better aware than I am that under the limitations of time imposed upon us most of the statements which I am about to make are little more than personal assertions, not indeed that my views are for the most part

merely the result of personal clinical observation which cannot be accepted by any one else as proof of their correctness. These observations have however extended over so long a period of time and have to the best of my belief been conducted in so skeptical a spirit, with so consistent an effort at the attitude of scientific doubt that I am personally very strongly convinced of their correctness. The practical results which have followed their adoption have moreover seemed to me to be so good that I am quite content to pursue the method in my personal work and am quite convinced that in the process of time they will prevail.

The uterus is situated in its position in the pelvis by the result of the action of a great number of unstriated muscular fibers

Immediately in front of the cervix and divided with scissors throughout its thickness, a narrow transverse strip being removed. The length of this transverse incision must vary somewhat with the size of the individual vagina but it should ordinarily be just sufficient to admit the operator's index finger. The anterior lip of the cervix is then seized with volsellum forceps, one blade of which enters the vaginal wound while the other lies within the cervical canal. Traction downward and backward brings Goffe's ligament into view. This is also divided transversely with scissors over the whole width of the transverse wound so exposing the loose connective tissue between the cervix and bladder. All the tissues in front of the cervix are then separated from it with the index finger passed through the wound up to or slightly above the level of the internal os, and as far out to either side as the finger can conveniently reach thus freeing the anterior surface of the broad ligaments as well as the cervix. The transverse wound in the vagina is then brought together by a transverse running suture, thus elongating the anterior vaginal wall. If the transverse wound is too wide some narrowing of the vagina may result but if this is watched for it can be avoided easily by a slight variation of the suture i. e. by bringing the lateral extremities of the cut together in the reverse direction (longitudinally to the vagina instead of transversely). During the first stage of this little operation there is frequently free bleeding, but it comes only from the cut edges of the vaginal wall and if the division of the deeper tissues is done with the finger all bleeding will be controlled by the sutures. It is often well to make sure that the cavity is clear of clot before closing it, either by the use of a sponge or by irrigation. At the conclusion of this stage of the operation the cervix will be found to have become freely movable and to have receded into the posterior cul de-sac, but since it is still crooked and the os still looks forward it is well in most cases to complete the operation by a dissection of the posterior lip. This I formerly did after the method of E. C. Dudley but experi-

ence has shown that this method leads to a subsequent eversion of the cervical mucous membrane in so large a proportion of cases that instead of making a simple median incision I now remove a lozenge-shaped portion of the posterior lip by four cuts of the scissors. The first two cuts divide the edge of the os at the same point in the median line but at the other end are from a quarter to a third of an inch apart. The next two cuts start at the extremities of the other two and meet in the median line, thus removing the lozenge. The upper apex of the lozenge should be externally at or nearly at the vaginocervical junction and internally should reach almost to the level of the angle of flexion in the individual case. Two sutures longitudinal to the vagina, one on either side of the cut, then bring the longitudinal points of the lozenge together at the cervicovaginal junction thus shortening the posterior lip of the cervix and yielding a straight uterine canal. After the recovery of the patient from ether the lower pole of the uterus will now be drawn strongly backward and upward by the unopposed action of the uterine scrabs, and the application of a suspension, or of any of the standard round-ligament operations to the upper pole completes the operation. There is now everything to keep the fundus forward and no opposing force to turn it backward.

Since the adoption of this procedure my percentage of failures after operations for the retrodeviations has diminished almost to the vanishing point, and I have come to feel that with this addition almost any one of the accepted operations is as good as any other.

I think that if you will treat my two main points—that abnormal anterior fixation of the cervix is the chief predisposing cause of the posterior deviations of the fundus, and that the operative release of this forward fixation of the cervix is a most potent addition to our means of combating such retroversions as need operative treatment—as hypotheses which are worthy of submission to observation and experimental use in your own daily work you will soon be forced to the point of accepting them as established to your content, as they already are to mine.



St. Luke's Hospital Chicago—unusual opportunities have been afforded me for the roentgenologic study of intestinal stasis. This opportunity has been especially rich in the surgical clinic of the Battle Creek Sanitarium and Hospital.

About two years ago the tentative rule was made that every case for which laparotomy was recommended should be subjected to a thoroughgoing roentgenologic examination before being sent to the operating room. These examinations were ordered not only for the purpose of gaining all possible information regarding the pathological features of the individual case, but also for the purpose of checking up the conditions which according to the roentgenologic examination, appeared to be normal, and also to check up the roentgenologic appearance of parts which at operation, were found normal.

After the first few months of this temporary rule for routine X-ray examination before laparotomy, the results in the way of help to the surgeon, and especially in connection with the problems of intestinal stasis, have warranted the continuance of this rule. At the present time with the exception of cases of acute appendicitis and ulcerations of the stomach or bowel where perforation seems imminent practically every case for laparotomy is referred to the roentgen examining room prior to operation. Out of an experience covering bismuth meal examinations of approximately three thousand cases studied both after the ingestion of a meal and during and following the injection of a bismuth enema, I have had the opportunity to follow a large number to the operating table. Not only have the X-ray findings been checked up by the report from the operating room, but the roentgenologist has made it a point to be present as one of the assisting surgeons at as many of the laparotomies as possible. Thanks to this opportunity I have accumulated a large amount of data concerning various portions of the alimentary tract which otherwise would not have been available. Inasmuch as many of the patients were operated on for gastric, gall bladder, uterine and other abdominal and pelvic conditions, often not associated with intestinal stasis, it

was extremely interesting to study the operative findings relating to kinks and torsions of the ileum and colon in connection with the motor function of the bowel, and particularly to note the frequency with which adhesions of the terminal ileum and colon were present in cases where from the bismuth-meal examination or other clinical means of investigation, intestinal stasis had not been suspected, and in which there was no reason to believe the existence of ileal stasis. Relatively few of the patients were operated on directly for the relief of intestinal stasis.

In the experience of my colleagues and myself it is with comparative rarity that radical surgery is necessary or profitable in dealing with intestinal stasis. Indeed Dr. J. H. Kellogg, chief surgeon, has stated it as his belief that in scarcely more than one case of alimentary toxemia in a hundred is short circuiting with or without colectomy a warrantable operation.

Certainly there are exceptional cases in which dietetic and other non-surgical means have been tried thoroughly and where short circuiting, especially when an artificial ileocolic valve is made, has resulted in almost marvelous improvement. But the real pernicious stasis, the intestinal stagnation which is really damaging, it seems to us, is not colonic stasis, but ileal stasis. The early work of Lane dwelt more upon the stasis in the colon, but within the last four or five years his efforts have been focused on ileal stasis, and he agrees that it is of far greater importance than colonic stasis. Granting for the moment that the stagnation in the terminal ileum is due to adhesions about the terminal ileum, cecum or appendix, short circuiting does not permanently relieve this ileal stasis unless a new ileocolic valve is made to act as a guard against the reflux of the contents of the colon back into the small intestine. In every case where I have made an examination with the X-ray following the short circuiting operation, I have observed retrograde peristalsis in the colon. In many of these cases there was also a reflux of colonic contents through the anastomotic opening into the small intestine and the resulting stasis in the small intestine converted the terminal ileum into a



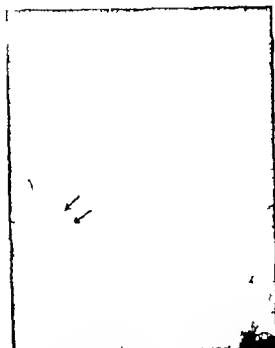


Fig. Lane's kink of the ileum. Roentgenogram thirty-four hours following the bismuth meal. The ileocecal valve was incompetent. The behavior of this case suggests that the Lane kink is merely an incidental and that the ileocecal valve incompetency is the real cause of the stasis.

unaware of the work of Hertz on this point. I suggested that many cases of ileal stasis were due to spasm of the ileocecal sphincter. As part of his contribution to the discussion of alimentary toxemia before the Royal Society of Medicine in the spring of 1913, Hertz again suggested that ileal stasis may be caused by spasm of the ileocecal sphincter.

In man, according to Keith, the musculature of the terminal portion of the ileum for the extent of nearly four inches above the ileocecal valve is endowed with a special tonic function whereby it serves as a sphincter for the terminal foot of ileum. Keith originally suggested that the function of the sphincter was to assist in preventing the content of the ileum from passing too rapidly into the caecum. Other thought that its function was to act as a barrier against the regurgitation of the contents of the caecum back into the ileum. Doubtless both functions are active, although the principal in-



Fig. Lane's kink of the ileum, associated with adhesions of the pylorus. Roentgenogram twelve hours post-cibus. Note the greatest distention of the ileum (a) is distal to the kink. The ileocecal valve was incompetent. The arrow marked (c) points the appendix, which lies across the ileum and is adherent to it.

fluence against the reflux of colonic contents is the muscular action of the ileocecal valve when it is competent.

The ileocolic junction, then, consists of two mechanisms: one the valve mechanism which mechanically prevents a reflux of the colon contents back into the ileum; the other the ileocecal sphincteric mechanism which controls the rate of passage of the contents of the terminal ileum into the caecum and probably also assists in guarding against regurgitation of colonic content.

Following a bismuth meal at least an hour elapses between the arrival of the first bismuth mixed chyme at the end of the ileum and the passage of any appreciable quantity into the caecum and four or five hours or more after the last portion of the bismuth meal has left the stomach the terminal ileum still contains bismuth. In other words, there normally occur in the lower end of the ileum a delay where the chyme remains undergoing digestion for a longer period than in

ventable colon so that the patient, instead of having a colon five feet long, possessed a colon of indefinite length. In some such cases I have seen the terminal ileum having the caliber of the colon itself so that when examined with the X ray it was not easy to differentiate ileum from colon.

The chief purpose of this paper is to review the conditions which have thus far been advanced as causes of ileal stasis, and to lay emphasis upon a new cause of ileal stasis to which I first called attention in 1909.

Leaving out of consideration tuberculous and malignant disease in the neighborhood of the ileocecal valve, there are, it seems to me three efficient causes of ileal stasis.

The first cause, as suggested by Lane and later demonstrated roentgenologically by Jordan, consists in adhesions of the terminal ileum. Lane considered the ileal adhesions and stasis both secondary to stasis in the large bowel giving rise to overloading of the cecum and obstruction of the ileal effluent either by an acquired mesentery an appendix hitching it up, or by simple stasis. But the acquired origin of the bands which Lane believes obstruct the ileum is questionable. According to Keith during the third, fourth, and fifth months of foetal life a profuse adhesive process sets in,—a regulated, embryological peritonitis—which leads to the cohesion of mesenteries and viscera to the posterior wall of the abdomen probably the adaptation to the upright posture. The extent of this process is extremely variable. Keith states that in about one newly born child in every ten the process of adhesions will be found to have bound the mesentery of the lower part of the ileum to the iliac fossa giving the appearance to which linking of the ileum is attributed. These adhesions may become so extensive as to give rise to the so called Jacksonian membrane. Keith recognizes, however, that all peritoneal adhesions in the ileocecal region are not embryological and normal, but that occasionally in adults there are found adhesion bands which are not seen in a child at birth. These may properly be considered possible causes of ileal stasis. The majority of the adhesions, however, are in reality mere expressions of a

normal and healthy foetal process. This view of the matter has also been suggested by C. H. Mayo, Eastman and others in America.

Ileal kinks are often found accidentally at operation and, since they may vary within certain normal bounds, in cases where their presence has been entirely unsuspected may we not properly inquire into the propriety of surgical treatment of these adhesion bands thus accidentally found, unless by previous clinical examination (particularly by means of the X-ray) stasis has been found to occur proximal to the so-called kink? Where obstructing kinks have been found, there was (1) a dilatation of the ileum proximal to the kink—not proximal to the ileocolic valve (2) delay in the ileum beyond the nine or ten hours considered the limit of its normal emptying time and (3) the stasis has occurred, as above noted, proximal to the kink—not proximal to the ileocolic junction.

Through the train of circumstances related earlier in this paper I have examined many cases of ileal stasis which have come to operation (uterine tumors, gall stones, gastric or duodenal ulcer as well as some extreme cases where the operation was done for the relief of the stasis) where no adhesions were found about the terminal ileum.

Hence we must conclude that (a) there are certain forms of obstructing ileal kinks but (b) there are numerous other cases which have come to operation for various causes, in which kinks have been found where a carefully conducted X ray examination has shown the absence of ileal stasis and where there were no other clinical evidences upon which to base a belief that ileal stasis existed. (c) There has been another class of cases in which ileal stasis existed and no adhesions have been found. Study of these cases has led to the conclusion that a large proportion of ileal stasis is due not to linking or adhesions of the terminal ileum, but to incompetency of the ileocolic valve, or to spasm of the ileocecal sphincteric mechanism, or to a combination of these two factors.

2. Ileocecal sphincter spasm as a cause of ileal stasis, I find was suggested as long ago as 1908 by A. F. Hertz. In September 1913 before the American Roentgen Ray Society



Fig. 1

Fig. 2

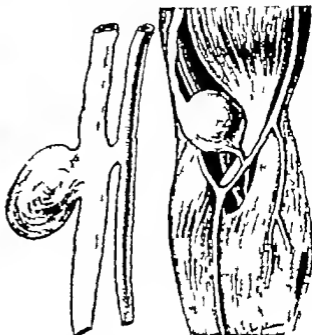


Fig. 3

Fig. 4

instances. The reason for the failure of this method is that the pathology of varicose aneurism is different from that of the ordinary aneurism. In the ordinary aneurism the ligation of the artery causes a deposit of fibrin in the sac on account of the lessened amount of blood slowly entering the sac. In varicose aneurism the communication through the sac with the vein offers an unimpeded passage of blood into the venous circulation. This prevents coagulation for blood in motion does not coagulate.

Spencer's operation is to cut down to the artery and ligate above and below the sac without disturbing the vein or opening the sac. The application of these ligatures removes the morbid influence of the retrograde current of arterial blood thus permitting the blood to coagulate within the sac and hence the consolidation of the tumor. Matas operations, extirpation or angiorrhaphy, i. e. extirpative or reconstructive are preferred however by surgeons at the present time for both varicose aneurism and aneurismal varix. The aneurism should be exposed by dissection and, if not too large, ligatures should be applied to both vessel above and below the

pathologic growth and the latter extirpated. This is a well recognized operation. In cases of varicose aneurism of the neck or of the anterior femoral region this procedure would however be attended with a grave prognosis. In some cases of varicose aneurism the sac is excised and the openings in the vessels closed by sutures. Likewise in some cases of aneurismal varix the adherent vessels are separated and the opening in each is sutured.

Some authorities contend that aneurismal varix should not be operated upon as long as it is not progressing ominously. It is borne without inconvenience and is not leading to complications. They advise that the patient wear a support. Should however the part become painful or the danger of rupture be imminent they claim operation should not be postponed. The writer does not subscribe to this principle any more than to the procrastinating policy of some physicians in their treatment of appendicitis.

In aneurismal varix of the carotid the internal jugular and of the common femoral vessels operative interference should be undertaken only when extremely urgent, owing to the unusual seriousness of the prognosis.



Fig. 3. Röntgenogram eight hours post-obstruction, showing the terminal ileum widely filled and trace in the cecum. The appearance of the terminal ileum just proximal to the ileocecal valve is that the enteric contents are characteristic of spaces of the ileocecal sphincter mechanism.



Fig. 4. Röntgenogram twelve hours post-obstruction, showing marked stasis in the terminal ileum with an apparent ileal knot at the arrow (a) about three inches from the ileocecal valve. The conical appearance of the terminal ileum at (b) just proximal to the ileocecal valve is characteristic of ileocecal valve incompetency and here present one may prophesy that the ileocecal valve will be incompetent at the extreme. No knot of the ileum was found in this case but the ileocecal valve is markedly incompetent.

the stomach. According to Hertz, a certain amount of ileal delay is thus a normal, physiological condition of the utmost importance for adequate digestion.

The behavior of certain striking cases which have passed under our roentgenological and surgical observation strongly supports the idea that the normal ileal retention is increased in all conditions leading to spasm, probably marked in chronic appendicitis, less marked in acute appendicitis. It is probable that other conditions perhaps even adhesions of the terminal ileum may also prolong the retention which, up to a certain degree, is normal in the terminal ileum.

3. As a new and additional cause of ileal stasis, I have suggested incompetency of the ileocecal valve. Kellogg, Groedel, Dietlin, Rieder and others have since agreed on the importance of recognizing this condition.

In 1909, I began to notice the frequency with which the bismuth enema passed beyond the ileocecal valve. Looking back over our statistics, I find this percentage very con-

stant about one out of every six gastro-intestinal cases showing incompetency of the valve. In 1911 I demonstrated roentgenograms showing incompetency of the ileocecal valve before the Gesellschaft für Innere Medizin, Vienna, and shortly after before the Royal Society of Medicine, Electro-therapeutic Section, London. Later before the American Roentgen Ray Society in 1912, also in 1913 I gave further papers on incompetency of the ileocecal valve. In 1912, I reported that out of a series of two hundred consecutive gastro-intestinal cases, one sixth showed incompetency of the ileocecal valve as determined by the barium chloride. In August, 1913 I reported more than two hundred and fifty cases of ileocecal valve incompetency and fifty cases of ileocecal valve competency (fifteen hundred) in each of which the competency of the ileocecal valve was tested. It should be noted that since these were gastro-intestinal cases referred for bismuth-meal examination, in-



Fig. 5. Mild gas distention of the abdomen, which is evidently in the small intestine, the colon being filled by the barium enema. This reticulated appearance of the abdominal shadow is characteristic of gas distention of the small intestine and is nearly always associated with ileocecal valve incompetency.



Fig. 7. Radiogram of the colon after barium enema injection. Ileum filled (C) by reflux through the ileocecal valve. Note the dilatation of the entire right half of the colon associated with spasticity of the ascending and pelvic colon (B) so often associated with ileocecal valve incompetency.

cluding suspected gastric ulcer, gastric carcinoma, duodenal lesions, gall bladder disease, chronic appendiceal disease, adhesions, kinks, torsions, spasms, and tumors of the colon, the presence of the ileocolic valve incompetency in this relatively large proportion of cases is not surprising. The majority of the patients were constipated.

Physiologists and anatomists agree that the normal ileocecal valve action successfully closes the ileum against the return of colonic contents, both gas and fluid. The proof of the existence of antiperistalsis, especially the proof that it occurs in man, increases the probability that the ileocecal valve should be competent under normal conditions. Our observations in connection with surgical work, as well as the observation of other surgeons during various abdominal operations, give abundant confirmation of the belief that the normal ileocecal valve is thoroughly competent. The ileocecal valve of the dog and of the pig are competent, withstanding enormous

gas and fluid distention of the colon. Numerous experiments have been performed to determine the normal competency or incompetency of the human ileocecal valve. The consensus of opinion is overwhelmingly in favor of its normal competency.

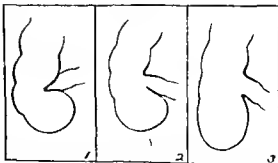


Fig. 6. Three figures (after Kelly) illustrating ileocecal valve incompetency: (1) normal ileocecal valve competency; (2) incompetency of the valve associated with dilatation of the upper part of the colon; (3) incompetency of the ileocecal valve with dilatation of both parts.



Fig. 8. Fluoroscopic view of the digestive tract. Marked ileocecal valve incompetency associated with spasm of the descending and pelvic colon. Several small diverticula of the cecum.

In fifty or more instances I have repeated the test of the competency of the valve on more than one occasion to determine whether or not the incompetency observed was transient or permanent. On some occasions the patients have been examined a third, and even a fourth time the interval between the different examinations being in several instances as long as three months. Without exception when the ileocecal valve has been found incompetent to the enema on one occasion it has been found incompetent at all subsequent observations.

Ileocecal valve incompetency has been observed not only after the clyster but also (and this must have still greater significance) after the ingestion of the meal. In more than fifty cases I have definitely proved the regurgitation of ingested bismuth from the colon back into the small intestine. For instance I have in numerous cases noted that the small intestine has been empty at the twelfth hour all the bismuth mixed content having passed on into the colon yet observation the next morning has shown bismuth

Fig. 9. Fluoroscopic view after the roine injection show the small intestine widely filled through the incompetent ileocecal valve. It can be seen the grade of incompetency by the degree of filling and the degree of distention the incompetency is very marked. Characteristically one of extreme alimentary tortuosity.

back in the terminal ileum, no new bismuth meal having been taken in the interim. This observation has been made repeatedly. If one doubts that the fact of incompetency is proved by the regurgitation of a bismuth enema into the ileum he must certainly admit that the ileocecal valve should normally prevent the regurgitation of ingested food back into the ileum especially ingested bismuth.

A further value of the fact of ileocecal valve incompetency is afforded by operative findings. In every instance where the ileocecal valve proved to be incompetent to the enema at operation the surgeon noted gas or fluid distention of the terminal ileum, which was often present to a distressing degree in spite of thorough efforts at pre-operative bowel cleansing. It is an easy matter to test the competency of the valve at the time of operation by the following method. The ileum being clamped off by the fingers of an assistant or by carefully protected instruments some ten or fifteen inches from the



Fig. Ileocecal al incompetency. Roentgenogram of the ileocecal region following the evacuation of the barium enema. The ileum is fully filled. A few traces remain in the cecum and ascending colon. The appendix was adherent to the terminal ileum. Removal of the appendix shown in Fig. cured the incompetency.



Fig. Retrocecal appendix, adherent to the ileum, associated with ileocecal valve incompetency. The removal of the appendix restored the competency of the valve.

ileocecal valve, its contents are milked down through the ileocecal valve into the cecum. The normal ileocecal valve prevents any regurgitation of the cecal gas or fluid contents back into the ileum even under considerable pressure, but the incompetent valve allows gas or fluid to pass back with readiness varying with the degree of incompetency.

Where the ileocecal valve has proved competent to the enema, the surgeon has, in the great majority of cases, confirmed this observation by the test described. There are occasional exceptions, however, in which the valve proved incompetent at the time of the operation in spite of the apparent normal competency to the barium enema. I think the failure to detect these cases by roentgenologic examination may be due to certain sources of error which are apparently unavoidable. These sources of error and the details of technique were discussed in a paper before the American Roentgen Ray Society.

Still further proof of the normal competency of the ileocecal valve is presented in the fact that the incompetency thus shown at operation has been cured in a number of cases by a simple surgical procedure. This ingenious operation for restoring the competency of the ileocecal valve has been described by Kellogg in a recent paper. The operation consists of skilfully placing several sutures in such a manner as to restore the invagination of the ileum without unduly narrowing its lumen. The operation is practically bloodless. It does not involve opening of the peritoneum, and it is quickly accomplished. At first Kellogg did not operate directly for the relief of the ileocecal valve incompetency. The operation was devised and performed in those cases which had come to operation for the relief of marked ileal stasis supposedly due to ileal kinks and yet where at operation, no ileal kink was found. Kellogg has since then felt that the field of this operation was somewhat more extensive and he has performed it up to the present writing (January 5, 1914) in an even hundred cases. The majority of these ileoce-



FIG. 1. Roentgenogram of the lower gastrointestinal tract. The patient has had an ileostomy. The transverse colon still retained considerable power on the third day. Roentgenogram of the lower gastrointestinal tract showing the ileostomy. The transverse colon still retained considerable power on the third day.

colic valve repair have been done in the course of operation for other causes when the routine preliminary X-ray examination has shown ileal stasis and where it appeared that the ileocecal valve incompetency was the cause of the stasis.

The most convincing argument of the efficacy of the ileocecal valve repair and therefore of the important part of the ileocecal valve in competency plays a factor in the production of ileal stasis, is found in the observation that whereas in all of these operated cases ileal stasis existed before operation post-operative studies have shown that in every instance the emptying time of the terminal ileum has been markedly diminished and in the majority of the cases it has been reduced to seven or eight hours. Not only has there been roentgenologic proof of lessened ileal stasis, usually lessened to within the normal limits, but there has been great improvement in the other clinical evidences of ileal stasis.

#### SUMMARY

While ileal stasis has been definitely shown to exist in connection with marked obstructing adhesions or kinkings of the terminal ileum, and while it is likely that spasm of the ileocecal sphincteric mechanism may be another factor in the production of ileal stasis, it seems demonstrated that incompetency of the ileocecal valve offers a further and more tangible explanation of ileal stasis and that it is probably the essential causative factor in the majority of cases of stasis in the terminal ileum. Ileocecal valve incompetency is almost invariably associated with the clinical evidences of intestinal stasis. Not all these patients have as yet a well-developed alimentary toxemia. One writer has stated that indeed almost our only treatment, surgical or medical, is the very primitive plan of keeping the bowel well cleaned out. Short-circuiting and colostomy operations are hazardous and often fail to cure. Appendectomy has been performed by some surgeons. My experience in the roentgen study of these cases of intestinal stasis, both before and after operation, leads me to distinctly oppose the tendency toward operative interference for the relief of intestinal stasis. While we should not for one moment lose sight of what has been accomplished by surgical interference, yet according to Kellogg not more than one per cent of cases of intestinal stasis are so severe that the operation of colectomy or short-circuiting is justifiable. As Keith has stated the colon is more of a misused than a useless structure owing to the extraordinary changes which have taken place in the diet of man in civilized countries. Surgery should not be seriously considered as the cure for ileal stasis until a most thoroughgoing trial has been made of the various dietetic and mechanical measures at our command. If an operative measure seems advisable recognition of ileocecal valve incompetency as a potent cause of ileal stasis may prevent a course of surgical treatment free not only from the dangers associated with short-circuiting with or without colectomy but actually calculated to restore normal physiological function.

## DIAGNOSIS OF THE PARTICULAR FORM OF HYDRONEPHROSIS DUE TO MOVABLE KIDNEY

By HOWARD A. KELLY M. D. and ROBERT M. LEWIS M. D. BALTIMORE

**N**OTHING looks more marvelous to the uninitiated and nothing is more gratifying to the expert than good diagnostic work in diseases of the kidney.

I well remember sitting on the benches at the University of Pennsylvania in the late seventies, when William Pepper, Professor of Medicine, brought before the class a rare case of a movable kidney. Not many perhaps seven, had been reported in the living, and in any individual case it required great diagnostic skill to determine that the organ felt was a kidney. This simply shows that while thermometers, stethoscopes, and direct auscultation and percussion were much in vogue a generation ago how little our forefathers used their hands in examining their patients. Nowadays one good clinic can often equal the thesaurus world's record in one active morning.

One of the diseases that has crept out of obscurity into the light of day is hydronephrosis. Formerly we only distinguished the end product, a great tense sac of fluid in a shell of a kidney. Now we recognize all the stages from the incipency in moderate distention up to the big, cystic practically dead kidney. The advantage of the change lies in the fact that in its early stages the condition is curable without mutilation, while in the latter it is not. It is of a case of this group that I desire to speak particularly, as I hope to demonstrate that by a combination of catheterization of the kidney and an X-ray examination with reasoning on known facts, not only can a diagnosis of hydronephrosis be made but the exact form can be determined before operating.

The case was that of a patient of Dr. D. 33 years old, married and the mother of one child 15 months old. The history given was somewhat vague, but the patient believed herself to be suffering from some form of gastro-intestinal disturbance. For years she was troubled with attacks of pain in the right

upper abdomen. This pain as a rule radiated to the right scapular region and at times seemed to be general throughout the abdomen. At the time of examination a painful point was noted midway between the region of the right kidney and the gall bladder. This passed downward to the crest of the ilium and down the outer side of the right leg.

The fact that the character or quantity of food taken appeared to make no difference in the symptoms would appear to argue against a gastric origin of pain.

The symptoms were not sufficiently acute or definite to indicate the presence of gall stones for this, too, the pain did not seem to have been sufficiently severe. There has been and is no tenderness in the region of the gall bladder; there has never been any jaundice.

Appendicitis was excluded in the right iliac fossa, and the pain area appeared to be too high to make this diagnosis likely. The bowels were obstinately constipated, but not particularly so at the time of the attacks.

Careful physical examination failed to exactly localize the pain or to discover any definite regions of tenderness. However, a most important find was made to wit, the right kidney was catheterized with a wax-tipped catheter which showed no scratch-marks on withdrawal.

One and one-half hours after hypodermatic insertion of 1 ccm. of phenolphthalein, 1 ccm. of urine was secreted by the right kidney which showed only a minute trace of the injected substance. In the same time 35 ccm. of urine was put out by the left kidney with a phenolphthalein content of 18.2. Eighty cubic centimeters of sterile boric acid colored with methylene blue was injected in the right renal pelvis through the renal catheter while a glass catheter was in the bladder to show any reflux. This produced a mild pain in the right iliac fossa, near the iliac crest, which the patient at once identified as the charac-

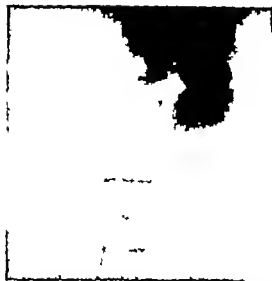


Fig. 1. The excellent radiogram shows the great distension of the renal pelvis filled with the heavy emulsion. The reproduction shows a distinct break between the shadow of the injected ureter and the bottom of the pelvis. The original radiogram shows fine dark lines connecting the lower end of the abdominal lumen between bones.

teristic pelvis from which he suffered. Let me emphasize the fact that only a small part of the solution injected returned through the catheter; in other words, the remainder was trapped in the renal pelvis.

The ureteral catheter was again introduced the following day and pushed up to a point a few centimeters below the renal pelvis. About 10 ccm. of a five per cent emulsion of silver iodide and 50 ccm. of a one per cent mixture of the same substance were then slowly injected into the renal pelvis. A radiogram was then taken after which some solution escaped by the catheter and a part was washed out. There was but little pain at the result of the injection.

We have here a reproduction of the plain radiogram which corresponds with the history and the physical examination and possible a most accurate diagnosis of the cause and seat of the trouble.

The ureter is distended with the silver iodide emulsion from the tip of the catheter up to a point one centimeter below the renal pelvis. The large dilated pelvis has beautiful

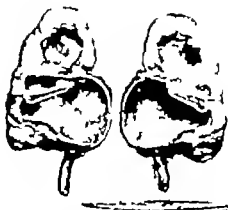


Fig. 2. Shows the dilated kidney after its removal. Notice the great distension of the pelvis with the opaque adherent ureter on its under surface.

fully outlined above. Between pelvis and injected ureter is an area in which the silicoid has not manifestly lodged. This evidently represents the site of the obstruction which is due not to the presence of a stone but to a kinking of the ureter just below the renal pelvis.

A diagnosis of chronic intermittent hydronephrosis was made and the right kidney removed.

At operation the kidney was found enlarged to a mere shell. The enlarged pelvis was readily exposed and a expected a right angle bend was found in the ureter just where it left the renal pelvis. The ureter itself was fast adherent to the lower surface of the pelvis for a distance of one and one-half centimeters. It then bent sharply downward in its normal direction.

The ureteral lumen was opened just below the kidney but none of the contents of the renal pelvis escaped until the dense adhesions holding the ureter on to the pelvis were dissected free. A gush of watery fluid containing particles of silver iodide then followed, and in this way the mechanism of the obstruction was clearly demonstrated. The arrangement of the part was like that of the stricture at the internal inguinal ring designed to prevent hernia. Here unfortunately the silicoid proved itself all too

competent and ended by bringing about the destruction of the kidney.

Section of the kidney shows but a rim of cortex. The hydronephrotic sac contained a considerable amount of the injected silver iodide emulsion. This is contrary to the experience that we have had in the case of injection of the pelvis and ureters of actively functioning kidneys where all traces of the iodide are generally removed within forty-eight hours. In such a case unless nephrectomy is to follow immediately the injection of any foreign material into the renal pelvis is undesirable if not actually dangerous.

Let us now reason a little about this most interesting patient.

In the first place every pain which is persistently lodged in one side in a patient who is not highly neurotic or hysterical, usually arises from some definite trouble in some one organ. When the pain is intermittent and more or less diffuse, extending at times down over the outer aspect of the thigh it is usually renal in origin.

The injection of 80 ccm through the renal

catheter which failed to return, was highly suggestive of a valvelike orifice of the ureter and therefore of hydronephrosis of that grade.

The bringing on of an attack similar to those complained of settled the diagnosis of hydronephrosis. The X-ray of the renal pelvis distended with silver iodide solution five per cent, now comes in with exquisite confirmation of the diagnosis, and with additional important information. In the first place the ureter ends abruptly at the renal pelvis. The pelvis is large and distended with the silver solution. Between the two parallel to the pelvis, a close examination can distinguish a fine line like a tiny thread of injection. These findings can always be interpreted as demonstrating as clearly as an autopsy that we are dealing with a hydronephrotic kidney with a valvelike ureteral orifice, which is bound down flat and compressed against the renal pelvis for about one and one half centimeters at its upper end. This was precisely what was found at the operation.

## REGENERATION OF CARTILAGE AND BONE WITH A SPECIAL STUDY OF THESE PROCESSES AS THEY OCCUR AT THE CHONDROCOSTAL JUNCTION

By S. L. HAAS, M. D., S. W. I. ANDERSON

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**T**WO tissues, cartilage and bone when fully developed are very easily distinguished from one another and there is nothing to suggest that they have a close developmental relationship. Cartilage is flexible cut easily and has a smooth, glistening surface and a homogeneous structure. Microscopically the cells which are situated in a uniform ground substance are of a single type varying only in size. In infancy and round at the center to small and flat toward the periphery where they gradually pass into a surrounding membrane called the perichondrium. Bone is firm cuts with difficulty and has a rough irregular surface with a complex architecture. Microscopically the cells are of various types which in the center form the complex marrow beyond which is the cortex made up of characteristic bone-cells lying in a uniform ground substance. The entire structure is surrounded by a thin membrane called the periosteum. In studying the embryological origin of cartilaginous bone its close relationship to cartilage becomes apparent. It will be found to have arisen from a blastemal yuccium of white fibrous tissue and to have passed through an intermediate cartilaginous stage.

Thus transition from the fibrous connective tissue to the simple cartilage and the complex bone involves as intricate a developmental problem as is met with in any of the developmental changes within the body. Here, as in all other developmental and regenerative changes, there is some unknown factor or force that initiates these transformations. This influence is often referred to as the inherent organization of the germ but we have no definite conception as to what that organization is. In the study of cartilage and bone it will be noticed that certain cells possess this inherent tendency to produce these specific types of tissue and although we cannot hope to determine what the stimulat-

ing factor may be we should at least be able to arrive at a uniform interpretation of the various steps of the process.

A review of the histogenesis of cartilage reveals the fact that there are still a number of disputed points in regard to the formation and structure of this simple tissue. It is not within the scope of this paper to deal with the minute cellular changes that take place in the regenerating cartilage but there are certain fundamental points that must be described. A recent article by K. von Korf (1) gives a detailed description of the development of normal cartilage which well exemplifies the complexity of the process. In the present discussion the chief problems to be considered are the relative importance of the original cartilage and of the perichondrium in forming the new cartilage.

A review of the histogenesis of bone likewise reveals the fact that there are a number of disputed points regarding the method of its formation. It is not necessary to deal here with the minute cytological changes that take place in the regenerating bone since in this discussion the chief problems to be considered are the relative importance of the original bone and of the periosteum in forming the new bone.

In the transformation of cartilage into bone the perichondrium takes a very active part in the perichondrial and in the endochondral ossification. Following the penetration of the perichondrial buds into the cartilage changes take place by which the marrow cavity and the cancellous bone are formed. The exact manner in which the cartilage is changed into bone has not been fully ascertained, some investigators believing that there is a direct change of cartilage cells into bone cells, while others the majority believe that the new bone is formed outside of the old cartilage which only act as a directing framework for the new bone. Coincident with the changes

that take place within the center of the cartilage there is a direct deposition of bone beneath the perichondrium. After the bony stage has been reached the perichondrium becomes the periosteum and the chondroblast becomes the osteoblast. Thus it is evident that there is a very close relationship between the perichondrium and the periosteum, between the chondroblast and the osteoblast and between cartilage and bone and it would be only natural to expect a certain parallelism in the method of regeneration of two tissues so closely related in their development.

It is to be hoped that the following experiments will aid in explaining some of the problems concerning the method of regeneration and development of bone and cartilage.

All of the observations in these 57 experiments were made upon the ribs and costal cartilages of rabbits; therefore the deductions as regards the regeneration of cartilage are naturally limited to hyaline cartilage and as regards the regeneration of bone are limited to the bones that arise from cartilage.

The various subjects will be taken up in the following order:

- I Regeneration of cartilage
- II Regeneration of bone
- III Regeneration of bone and cartilage at the chondrocostal junction
  - (a) Regeneration of bone at the junction
  - (b) Regeneration of cartilage at the junction
  - (c) Regeneration of bone and cartilage at the junction

#### 1. REGENERATION OF CARTILAGE

There is a rather general idea that cartilage possesses only a slight power of regeneration and it is even held by some that this power is entirely lacking. The greater number of investigators admit that cartilage has the property of regenerating, but there is no uniformity of opinion as to the exact method.

Matsuoka (2) gives a complete and concise review of the principal articles that have appeared under regeneration of cartilage up to the year 1904. The consensus of opinion at that time was that the regeneration takes place only from the perichondrium, but there was a difference of opinion as to the exact

method by which the perichondrium produced the new cartilage. It was believed by some that the perichondrium only changed the surrounding connective tissue into cartilage while others believed there was a direct proliferation of the perichondrial cells. A few investigators thought that the regenerated cartilage came from the old cartilage or from the old cartilage and the perichondrium together. Matsuoka concluded from his experiments on the ear cartilages of rabbits that the perichondrium was the only source for the new cartilage.

Since the appearance of Matsuoka's article a few important papers have appeared, and they will be shortly reviewed.

An article by Maltesta (3) contains some interesting points. His experiments were performed upon rabbits at the age of eight to ten months. He either scratched the perichondrium from the rib cartilage, cut the cartilage in two or removed a triangular piece of cartilage. He reported that there was a calcification of the cartilages that were operated upon in all of the animals. A distinction is made between the first to the seventh and the eighth to the twelfth ribs. In the first to the seventh which are designated as the thick ribs, after a complete resection there was a perichondrial growth on the outside then a calcified layer and in the center a layer of cartilage. In the eighth to the twelfth ribs, designated as the thin ribs, the central layer was also calcified. Only in small incomplete cut wounds or in incompletely calcified cartilage can a partial healing through cartilage tissue take place. Exceptionally the cartilage and connective tissue surrounding the wound produces young connective tissue which later on may be changed into hyaline cartilage. The change of the connective tissue always takes place under the influence of the perichondrium. The cartilage producing properties of the perichondrium are greatest in minor injuries and might be entirely lacking in the larger destruction of cartilage. Although he acknowledges the importance of the perichondrium, he does not make clear whether it directly forms cartilage or whether it only influences the new formed connective tissue to form cartilage.

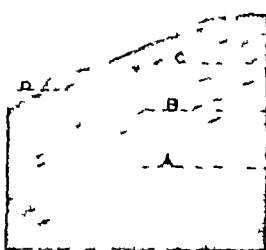


Fig. Normal stripped-off perichondrium. A fibrous outer layer B layer of plate-like nuclei C oval nuclei D paired vesicular nuclei. Microphotograph (Fig. 4) (A, B & C).

The study of transplanted pieces of cartilage gives us some information as to the part the different regions of cartilage take in the regeneration.

Ashmun (4) from his experiment concluded that only the part near the perichondrium formed new cartilage.

Davis (5) in a series of experiment on the transplantation of the rib cartilage of dogs from three months to two years of age found no evidence of degeneration either macroscopically or microscopically after the lapse of four months. The perichondrium was also transplanted in these experiments.

Before proceeding with the experimental part of this work it will be necessary to give a definition of the perichondrium as it is here considered. Since the experiment was made upon the ribs the conclusions are necessarily limited to hyaline cartilage with perichondrium although they will probably apply to other kinds of cartilage.

The perichondrium of the costal cartilage is a thin membrane which can be separated from the underlying cartilage providing the exact line of cleavage is found. At the chondrocostal junction it becomes thicker and

more adherent and is continuous with the periosteum.

Under the microscope it is impossible to make out any separation between the perichondrium and the true cartilage. The outer layer of the perichondrium consists of loosely arranged fibrous tissue beneath which are longitudinally placed platelike nuclei. In the next layer the nuclei are larger oval in shape and stain lighter and they are not so close together. These latter nuclei shade off gradually into a group which are slightly larger and have a more vesicular appearance. Many of the latter are in pairs as though they were dividing. As will be seen from the description of the stripped-off perichondrium, this layer marks the line of separation between the perichondrium and the cartilage. The next cells are the very youngest of the cartilage cells which are often removed with the perichondrium.

To determine accurately the constituent elements of the perichondrium, it seems better to describe its appearance as we find it after it has been stripped from the cartilage. Under high magnification the perichondrium is seen to consist of an outer loosely arranged fibrous layer a median compact layer with platelike nuclei and an inner layer of oval nuclei among which are paired vesicular nuclei (Fig. 1). Scattered throughout the inner layer there are some cells which are either young or intermediate cartilage cells.

The examination of the cartilage after the removal of the perichondrium shows on the surface a varying appearance on account of the irregular separation of the perichondrium. In places the young cartilage cells are on the outer margin, while at other points the paired vesicular nuclei are noticed.

From this detailed description it is seen that there is no sharp separation between the perichondrium and the underlying cartilage. It is given in order that the author's conception of the structure of the perichondrium may be fully understood and the following explanation correctly interpreted.

#### EXPERIMENTAL RESECTION OF CARTILAGE

Method. The first of the experiment were performed upon the ribs of a dog. An incision

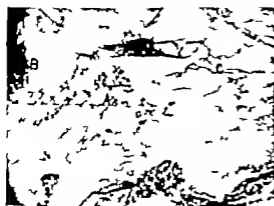


Fig. 2. Regeneration of cartilage from the perichondrium 48 days after subperichondrial resection. A, regenerated cartilage from the perichondrium showing multiciliated cells; B, cartilage stump; C, one end of perichondrial gutter containing fibrous tissue. (Microphotograph, Obj. 10x, inch R & L.)

was made through the skin and muscle down to the cartilage of the ribs. One of the larger cartilages was selected and a longitudinal cut was made through the perichondrium. By careful dissection the perichondrium was separated from the underlying cartilage but owing to the shape and flexibility of the cartilage it was difficult to remove it completely. A piece of cartilage from one to two centimeters in length was removed after which the severed tissues were approximated with silk sutures. A bandage was applied to the chest and the animal allowed its freedom.

**Results.** In 11 out of 13 experiments of this nature cartilage was found in increasing amounts proportional to the length of time that had elapsed, which was 5, 10, 15, 20, 25, 30, 35, 38, and 40 days, respectively. In two cases of 5 and 20 days duration no evidence of new cartilage was found on macroscopical examination.

In order to determine the method of regeneration a series of sections were made at 5, 7, 10, 15, and 20 days. The tissue was fixed in Orth fluid, embedded in paraffin and stained with hematoxylin and eosin or an iron-haematoxylin.

#### Experiment 1. Rabbit 267, 5 days

*Gravimetric examination.* The perichondrial gutter is filled with new tissue.

*Microscopical examination.* The stump of the cartilage shows some light proliferation of cells.



Fig. 3. Regeneration of cartilage from perichondrium 7 days after resection. A, regeneration of cartilage from the perichondrium; B, perichondrium; C, perichondrial gutter. (Microphotograph, Obj. 10x, inch R & L.)

the surface near the perichondrium. Back from the cut edge proliferation of the region of the perichondrium is to be found. The perichondrial gutter is filled with fibrous and young connective tissue. The perichondrium cannot be identified at this time. The nuclei of the inner layer of the perichondrium have lost their staining power although the rest of the cells appear to be proliferating. In several parts of the section there are collections of groups of nuclei which have the appearance of undergoing mitosis (Fig. 4).

#### Experiment 2. Rabbit 7, 7 days

*Gravimetric examination.* The perichondrial gutter is filled with new tissue; the exact nature of which cannot be determined.

*Microscopical examination.* The cartilage at the stump end is rapidly degenerating; no evidence of proliferation except along the outer margin near the perichondrium. There is some proliferation of the perichondrium extending back of the cartilage stump. The perichondrial gutter is filled with young connective tissue formed by the organization of the exudate as previously described. The perichondrium shows changes throughout its entire structure. In the innermost layers the nuclei have lost their staining reactions (Fig. 5). This degenerating tissue looks like cartilage cells that have been removed with the perichondrium and it seems to indicate that even if cartilage removed with the perichondrium takes no part in the regeneration. The remainder of the perichondrium is actively proliferating to form new cartilage tissue.

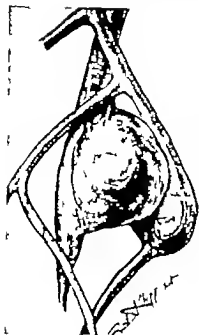


Fig. 5



Fig. 6

Stewart (7) recently reported an instructive case of aneurysmal varix of the femoral vessels treated by angiorrhaphy. This occurred in a boy three years old, during circumcision. While performing the operation the surgeon laid the scalpel on the left groin, the patient suddenly flexed his left thigh, impaling it upon the knife. A furious hemorrhage resulted; this was controlled by enlarging the wound and applying ligatures to the femoral vessels. A month later a systolic murmur was found over the right heart, together with cardiac hypertrophy. On admission to the hospital four years later a scar was found on the middle of the anterior surface of the left thigh. Over this a continuous thrill was felt and a bruit was heard; the latter was transmitted down the femoral vessels to the knee, and up as far as Poirson's ligament. Both thrill and bruit were reinforced at each arterial systole and both ceased when firm compression was made over the scar. The veins were dilated and the limb cyanosed. Besides, the limb was an inch longer than the right, and half an inch greater in circumference, although there was no edema. In operating, the femoral

vessels were exposed above the scar and traced downward. The vessels were adherent for about half an inch, but there was no sign of any intermediate sac. The vessels were separated with a sharp knife, and the opening in each, about one eighth inch in diameter, closed with sutures of fine silk. A flap of the vastus internus was passed around the artery so as to form a canal and separate it from the vein; the wound was closed and the limb placed in a splint applied loosely to the root of the thigh so that in case of hemorrhage the nurse could at once control it. The pulse at the foot reappeared as soon as the blood current was turned on. The murmur of the heart disappeared and the organ diminished considerably in size. The patient was discharged ten days after the operation.

As to treatment, separation of the vessels with exclusion of the sac, if such there be, and suture of the opening in the artery and in the vein, is an ideal method in all cases in which the major vessels are involved and in which the operation is possible. Extirpation of the aneurysm after ligation of both artery and vein, above and below, is the only rival of



Fig. 8. Regeneration from the perichondrium five days after subperiosteal resection. A, outer side of perichondrium; B, new formed chondroid tissue from the perichondrium; C, osteoblasts capping the new tissue; D, organized fibro in the perichondral gutter. (Microphotograph Obj. 5. Occ. inch, B & L.)

ilage, which is formed independently of the perichondrium, is also assuming a cartilaginous structure (Fig. 9). This again suggests that the perichondrium is exerting some influence over the connective tissue to transform it into cartilage, and it is possible that it is source of some of the cartilage. A short distance away from the stumps there is some new cartilage which is connected neither with the perichondrium nor with the original cartilage and its exact origin cannot be definitely determined from these sections.

#### Experiment 5. Rabbit 271. 20 days

*Gross examination.* The entire perichondral gutter appears to be filled with new cartilage.

*Microscopical examination.* At this stage the cartilage formation is much denser. The independence of the perichondral origin of that from the stumps is quite apparent. The cartilage stumps appear to be degenerating in the cut surface and within this area there is suggestion of calcification of the old cartilage.

*Conclusions.* From the foregoing experiments it is obvious that the chief source of the regeneration of cartilage is from the perichondrium. The change is produced by a proliferation of certain cells of the perichondrium to form the young cartilage-tissue.

In case any of the true cartilage is removed with the perichondrium, it does not take part in the regeneration but undergoes degeneration.



Fig. 9. Same as Fig. 8, only near the cut end of the rib. A, perichondral new formed chondroid tissue; B, lower layer of cortex; C, perichondral gutter; D, slight growth from endosteum; E, upper layer of cortex. (Microphotograph, Obj. 5. Occ. inch B & L.)

From some of the sections it would seem that there is a direct transformation of connective tissue into cartilage due perhaps to some specific stimulus of the perichondrium or of the cartilage.

The cartilage stumps take a very inactive part in the regeneration, and at times undergo degenerative changes. It is possible that the cartilage might have some tendency to transform the surrounding connective tissue into cartilage.

Some investigators have described calcareous changes in the regenerated cartilage after the thirty-fifth day. In animals that were from eight to ten months of age. In these experiments there was never any evidence of calcification of the regenerated cartilage even after the lapse of forty-six days.

Various observers have failed to find regeneration when a considerable piece of cartilage had been removed but in the above experiments regeneration occurred regardless of the amount of cartilage removed.

#### RESECTION OF A PIECE OF CARTILAGE WITH ITS PERICHONDRUM

In order to emphasize the importance of the perichondrium as a factor in the regeneration of cartilage the following additional experiments were performed.



Fig. 4. Regeneration of cartilage fifteen days after sub-perichondrial resection. A, cartilage of eye; B, new cartilage from the perichondrium; C, photograph of the whole specimen (see text B & L).

#### Experiment 3. Rabbit 426. 10 days.

*Gross examination.* There is a tubular mass of tissue in the perichondrial gutter but its exact identity cannot be determined.

*Microscopic examination.* At this stage there is marked growth of new cartilage; the greater part of which comes from the perichondrium. There is considerable amount of new cartilage about the cartilage stump and in places it is in such close contact with the original cartilage that it appears to be continuous with it. In other places there is a distinct line of

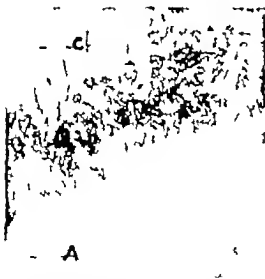


Fig. 5. Regeneration of cartilage from the perichondrium fifteen days after sub-perichondrial resection. Higher magnification from section in same series as Fig. 4. A, outer layer of perichondrium; B, new cartilage from perichondrium; C, connective tissue in perichondrial gutter. Notice the change in density of the new cartilage (Microphotograph, Obj. 4. Occ. see text B & L).



Fig. 6. Cartilage fifteen days after removal of cartilage with perichondrium. A, cartilage-stump; B, connective tissue between stumps; C, beginning of regeneration of cartilage (Microphotograph, Obj. 4. Occ. see text B & L).

union from the new formed cartilage to the surrounding young connective tissue and from such a picture the interpretation might be made that this cartilage has been formed by a metaplasia of connective tissue.

#### Experiment 4. Rabbit 321. 15 days.

*Gross examination.* There is almost complete filling of the gap with new cartilage.

*Microscopic examination.* The cartilage stumps end abruptly. The greater part of the regenerated cartilage arises from the perichondrium (but not all). All the layers of the perichondrium appear to be taken part in the new formation of cartilage and the connective tissue and core of the new car-



Fig. 7. Normal stripped-off perichondrium. A, outer fibrous and inelastic layer; B, layer of plastic-like nuclei; C, layer containing round and oval nuclei (Microphotograph, Obj. 6. Occ. see text B & L).

osteum and the metal plate it is possible that there would have been new bone formed from the periosteum owing to the presence of a more stimulating and nutrient pabulum.

McWilliams (9) concludes from his experiments on the transplantation of bone that the periosteum is of importance not so much for its osteogenic properties as for its power to increase the blood supply. The exact manner in which the periosteum increases the blood supply is not stated. It would seem that the periosteum would prevent the penetration of blood-vessels, thereby decreasing rather than increasing its vascularity.

Groves (10) in an excellent and extensive article on the experimental production and treatment of fractures, ascribes no osteogenic function to the periosteum. One cannot but feel that he is somewhat influenced in his deductions, as a study of his experiments and photographs presents just as much evidence for the osteogenic power as against it. Like Macewen he defines the periosteum as consisting of a fibrous layer only but in his experiments he makes use of the same membrane that all operators and investigators consider to be the periosteum, which consists of more than a fibrous layer as stated in his definition. As will be shown later the membrane that is removed with care from the bone which is considered by all as the periosteum, has a definite microscopical appearance. Naturally the outer layer of this membrane is not osteogenic because if it were there would be just as much growth on the outside of the periosteum as within, but the immediate layer of cells beneath this layer is a definite part of the periosteum and is capable of producing bone. If this layer is not to be included in the periosteum, then there must be a new definition for periosteum by which an artificial separation of a definite anatomical structure is described.

A recent article by Mayer and Wehner (11) on the regeneration and transplantation of bone presents some very decisive evidence against the theory of Macewen and his followers. They found that young periosteum, when transplanted into muscle, was capable of regenerating bone. They also found that the periosteum, after subperiosteal resection

of the ribs, was capable of regenerating new bone. In another set of experiments they placed a glass or steel cap beneath the periosteum, which extended into the cortex for a short distance so as to prevent periosteal ingrowth. There was failure of regeneration of bone inside the capsules when there was no penetration of the periosteum. This emphasizes the importance of the periosteum in all regenerative processes of bone and shows the relative inactivity of cortical bone. In their transplantation experiments they agree with Axhausen that the greater part of regeneration takes place from the periosteum, but that there is also proliferation from the endosteum.

On account of the confusion that has arisen over the definition of the periosteum it becomes imperative to give an exact description of that membrane.

The periosteum is usually described as consisting of an outer fibrous layer, a middle fibro-elastic layer and an inner osteogenic layer in which are a large number of embryonal connective-tissue cells (the osteoblasts). After growth has ceased this osteogenic layer is reduced to an inconspicuous stratum. According to Macewen there is a loose layer of areolar tissue beneath the periosteum.

Examination of the periosteum covering the rib shows an outer loose fibrous and fibro-elastic layer. This latter layer merges into a group of cells with platelike nuclei which are closely packed together and which extend almost to the cortical bone. On approaching the cortex one can see some moderate sized oval vesicular nuclei. It is possible that these two kinds of cells are dormant osteoblasts. On the outer surface of the cortex the nuclei are spindle shaped and pyknotic. In a normal section there is no demonstrable separation between the periosteum and the cortex excepting where artificially separated during the process of cutting.

Examination of the stripped periosteum shows an outer fibrous and fibro-elastic layer which merges into a cellular layer of the platelike nuclei as described above (Fig. 7). On the inner side of this fibro-elastic layer are groups of cells with vesicular oval nuclei, and others with pyknotic round nuclei but there are never any cortical bone-cells to be found.

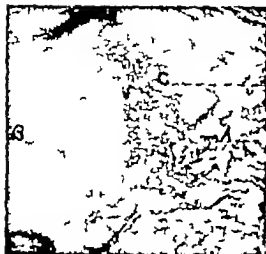


Fig. 6. Regeneration (bone and cartilage) after subperiosteal and subperitoneal resection of the chondrocostal junction with resection of the periosteum. A, regeneration on the inner wall of the periosteum; B, regeneration on the cartilaginous side; C, regeneration of chondrocostal junction; D, hyperostosis (Hj. Orr, March 22, 1911).

**Method.** Thus yet 5 experiments differed from those just described in that the perichondrium was removed with the resected piece of cartilage. After such a resection if any regeneration occurs it must originate from the perichondrium covered stumps at either end of the gap.

**Results.** In three experiments of this nature gross examination showed entire absence of cartilage formation between the two stumps after the lapse of 15, 23 and 33 days respectively. In the experiment which lasted 15 days microscopic examination verified the findings.

**Experiment 6.** Rabbit 331, 15 days. This experiment is to be compared with Experiment 4, as it was carried out on the same animal at the same time and under similar conditions. It differs from the other because in this case the perichondrium was removed with the cartilage.

**Gross examination.** There is no evidence of growth from the cartilage stumps or the intervening tissue.

**Microscopical examination.** There is a slight regeneration of new cartilage near each of the cartilage stumps which appears to come from the perichondrium. The gap between the two stumps is filled with

connective tissue and there is an entire absence of new cartilage (Fig. 6). In Experiment 4, which differs only in that the perichondrium was allowed to remain there is a considerable amount of new cartilage in the gap between the two stumps (compare Figs. 4 and 6).

**Conclusion.** No doubt can remain as to the important part the perichondrium takes in the regeneration of cartilage, also that connective tissue without the aid of perichondrium or cartilage is not capable of changing into cartilage.

## II. REGENERATION OF BONE

In a previous paper (6) concerning the relation of the periosteum to the regeneration of bone I came to the conclusion that the periosteum had the power to regenerate bone independently of any preexisting bone especially in the presence of blood clot.

In that article a general review of the literature was given, so it will only be necessary here to call attention to the important articles that have appeared since that time.

Riverson (7) reports from the roentgenoscopic examination of the early changes that take place in fractures that there is no regeneration from the periosteum because he does not see any new bone formed in the angle where the periosteum is stripped up from the cortex. It is hardly to be expected that the very early changes in bone formation would be noticeable in a roentgenogram especially where there is an absence of lime salts. However if one makes a microscopical study of these early changes in fractures it is easy to see that there is a new formation of bone at the place where the periosteum is elevated from the cortex.

Willie and Robertson (8) give their findings in a series of experiments and conclude that the periosteum is unable to regenerate bone. In their experiments they have separated the periosteum from the cortical bone by means of tin foil or other metallic substances, and they found no evidence of bone formation from the periosteum. By placing the periosteum in contact with a metal or foreign body they have not placed it under conditions which are favorable for proliferation. If in these experiments a layer of blood clot had been inserted between the stripped-up peri-

*Microscopical examination* The process differs from that found in Experiment 9 in that the osseous tissue is more dense.

#### Experiment 11 Rabbit 73 29 days

*Gross examination* There is complete filling of the periosteal gutter with new bone.

*Microscopical examination* There is less bone and more cartilage at this time than in the previous experiment, in spite of the fact that longer time had elapsed. There is no definite order in the arrangement of the cartilage and the bone.

*Conclusions* From the microscopical study of these cases it is apparent that the periosteum is very actively concerned in the regeneration of bone. There is at first a proliferation of all its cellular elements to produce a cartilaginous material which is in turn transformed into bone. In the very early stages there is no growth from the cortex or from the marrow, but later there is a limited amount of regeneration from these parts.

There is considerable irregularity in the relation of and the amount of bone and cartilage formed at different periods, which might be dependent upon the age of the animal, the amount of tissue to be regenerated, the presence or absence of blood-clot and the injury to the periosteum.

From many of the sections it appears as though there is a direct transformation of cartilage cells into bone cells, while in others it appears as though the new bone is being formed outside of and gradually displacing the cartilage, which merely acts as a framework. The findings from these experiments may be interpreted as evidence in favor of either method of bone formation and it is possible that both may play a part in the process.

*Comparison of the regeneration of bone and cartilage* In the regeneration of cartilage and bone it has been shown that the perichondrium and the periosteum take an analogous part in the formation of their respective new tissues.

The periosteum is a direct derivative of the perichondrium, and the osteoblast is a direct derivative of the chondroblast. In the regeneration of bone the osteoblast tends to revert to the chondroblastic type as is shown by the formation of cartilage in the early stages. In the regeneration of cartilage there

was some evidence of the reversion of the chondroblast to the connective tissue type of cell, as was noticed in the tissue about the new-forming cartilage.

After the periosteum has proliferated into cartilage it is rapidly transformed either directly or indirectly by some specific influence perhaps of a chemical or physical nature into bone. The cartilage on the other hand continues to grow as cartilage but that it may also be changed into bone is shown by the fact that ossification occurs in cartilage in old age.

The governing and determining force is the same as that which is fundamental to all growing conditions and is dependent upon a specific property of the cell which determines the character of the tissue to be formed in each case.

### III THE REGENERATION OF CARTILAGE AND BONE AT THE CHONDROCOSTAL JUNCTION

The chondrocostal junction affords an opportunity for studying regeneration of bone and cartilage at the same time and of determining the parts that the perichondrium and the periosteum exert in the restoration of the cartilage and bone respectively.

The normal chondrocostal junction has a very close resemblance to a normal epiphysis and is affected in a similar manner in certain diseases. During the period of growth of the chest it possibly acts as an epiphysis in increasing the circumference but after the adult period has been reached, instead of undergoing the usual changes the cartilage persists and assumes the function of giving elasticity to the chest wall. In the anatomical description of the ribs no mention is made as to whether the chondrocostal junction is to be considered as an epiphysis. If it be granted that it acts as an epiphysis even in a limited degree the following findings will be of especial interest.

As there are certain peculiarities of the perichondrium and the periosteum and their enclosed tissues at the chondrocostal junction, it will be necessary to give a detailed description of their structure.

At the chondrocostal junction the periosteum is seen to become thicker and to extend

This description of the periosteum agrees with that usually given by the embryologist, anatomists, and histologists who in general believe that it has osteogenetic properties, and it has been so applied as a basis of the following experiment.

Examination of the surface of the bone after removal of the periosteum shows groups of cells with platelike and vesicular nuclei which are identical with those found on the inner portion of the periosteum, and it seems more probable that these are portions of adherent periosteum than that they are portions of the cortical bone.

#### SUBPERIOSTEAL RESECTION OF A RIB

**Method.** One of the larger ribs was selected and after the periosteum had been carefully separated a piece of rib from one and one-half to two centimeters in length was removed. No attempt was made to check any light bleeding into the periosteal gutter. The tissues and the skin were approximated with silk sutures.

**Results.** In all of the seven experiments of this nature there is regeneration of bone in various stages in the periosteal gutter. In the very early stages the new tissue is cartilaginous in nature, but at ten days the deposition of new bone is quite noticeable. A detailed description will be given only in those cases in which a microscopical examination was made, namely at 5, 11, 15, 26 and 29 days, respectively.

#### Experiment 7 Rabbit 267 5 days

**Gross exam. notes.** Nothing but blood can be seen in the periosteal gutter.

**Microscopical examination.** The periosteum cannot be recognized at this time as there has been a proliferation of all the cellular elements in thin outer fibrous layer. In the periosteal gutter there is a light bluish staining tissue which looks like young cartilage and which is capped by a layer of osteoblasts (Fig. 8). The cut ends of the ribs show absolutely no evidence of new growth. There is slight amount of new bone formed from the endosteum (Fig. 9). A study of the angle formed by the stripped up periosteum and the cortex shows even at this time deposition of osseous tissue.

The question arises as to the origin of this new bone at the angle. The possibilities are that it can come from the periosteum, from

the cortical bone or from the osteoblasts that have wandered out from the Haversian canals and the marrow of the bone. If the osteoblasts came from the Haversian canals and the marrow it is surprising that there is no new osseous tissue at the cut ends at which place there is ample opportunity for free migration of such cells. If the bone was formed from the cortex, then it should be uniformly deposited along the surface of the cortex and on the cut ends of the cortex but the sections do not show that this takes place. Therefore it must be that the new bone has originated from the periosteum and there is considerable evidence that this is the case. It is noticed that there is a uniform transformation of the periosteum to chondroid tissue which is just as marked at the center of the gap as at the ends (compare Fig. 8 from the center with Fig. 9 at the end).

#### Experiment 8 Rabbit 275 11 days

**Gross exam. notes.** The periosteal gutter is filled with new tissue which appears to be cartilaginous near the bone and calcareous toward the center.

**Microscopical exam. notes.** The periosteal gutter is filled with new tissue, much for the most part is of cartilaginous nature, but in which there is small red areas of osseous tissue. The periosteum is no longer recognizable, the greater number of its elements being involved in the formation of the new tissue. There is no regularity in the distribution of the osseous and cartilaginous tissue. The process is slightly more advanced than in the previous experiment.

#### Experiment 9 Rabbit 273 15 days

**Gross exam. notes.** With the exception of small amount of cartilaginous tissue near the stumps, the periosteal gutter is filled with osseous tissue.

**Microscopical exam. notes.** One is immediately impressed with the large amount of bone present at this time, as it practically fills the entire space. Under the high power the remains of the cartilage cells can still be seen and although it is generally denied that the cartilage cell can be transformed into a bone-cell, it often appears as though such process were taking place in these regenerative changes. There is considerable proliferation from the bone stumps and this new bone is becoming distinctly united to the periosteal bone. The periosteum is beginning to assume its normal appearance.

#### Experiment 10 Rabbit 994 26 days

**Gross exam. notes.** There is complete filling up of the periosteal gutter with calcareous material excepting for a small island of cartilage near the center.

## Experiment 16 Rabbit 276 5 days

*Gross examination* No changes can be made out at this time

*Microscopical examination* There is a slight proliferation of all the layers of the perichondrium

## Experiment 17 Rabbit 426 10 days

*Gross examination* There is considerable amount of new tissue in the perichondral gutter which appears to be cartilaginous

*Microscopical examination* There is an active growth of new cartilage between the two stumps which is definitely of perichondral origin. There is no growth from the cartilage stump except in the neighborhood of the perichondrium while from the bone stump there is some proliferation from the cancellous bone islands

## Experiment 18 Rabbit 319 15 days

*Gross examination* The perichondral gutter appears to be filled with fibrocartilaginous material

*Microscopical examination* The appearance is similar to that described in Experiment 7 differing only in that the process is more advanced

## Experiment 19 Rabbit 1 20 days

*Gross examination* The space between the two ends is completely filled with new cartilage

*Microscopical examination* There is slight increase in the amount and density of the regenerated cartilage and the greater part of it arises from the perichondrium. It is interesting to follow the changes at the bone-stump, as there appears to be direct transformation of bone into cartilage. The bone at that place is arranged in islands which are beginning to take on bluish tinge like cartilage. The nuclei of the bone-cells are enlarging and appear to be changing directly into cartilage cells. In view of the fact that there is considerable dispute as to whether cartilage cells can hang directly into bone-cells, this retrogressive change of the bone-cell to the cartilage cell is especially interesting

*Conclusions* With cartilage at one end and bone at the other end of a strip of perichondrium the regenerated new tissue will be cartilage but if the intervening strip consist of periosteum the regenerated tissue will be bone. Admitting that the two stumps in either condition proliferate to a slight extent, one cannot but admit that the periosteum and the perichondrium determine the character of the regenerated tissue. From the sections it is evident that the regeneration is due to a proliferation of the cellular layers of the periosteum or the perichondrium, independent of the adjoining tissue

The next set of experiments add further proof to these assertions.

## (c) REGENERATION OF BONE AND CARTILAGE AT THE JUNCTION

*Method* The bone and cartilage were subperiosteally and subperichondrally resected so as to include the chondrocostal junction

*Results* At periods of 5 7 10 13 15 20 27 and 43 days there were bone and cartilage regenerated on their respective sides of the junction

## Experiment 19 Rabbit 349 5 days

*Gross examination* No blood clot can be seen in the intervening space

*Microscopical examination* It is interesting to note that the regeneration of bone and cartilage are going independently on their respective sides of the junction. No additional conditions occurred besides those previously described for each type of regeneration for this stage

## Experiment 20 Rabbit 320 7 days

*Gross examination* Nothing definite as to the nature of the tissue in the gutter can be ascertained

*Microscopical examination* There is regeneration of bone up to the junction, at which place the new cartilage begins and extends up to the cartilage stump

## Experiment 21 Rabbit 275 10 days

*Gross examination* On the side toward the rib-stump there is calcareous material which becomes continuous with cartilaginous tissue at the chondrocostal junction

*Microscopical examination* At this stage there is more advanced development of cartilage and bone on their respective sides of the junction. These two tissues meet in an irregular manner at the junction, but it looks as though there was an effort to adjust themselves to the growing forces and that they were tending to establish condition of equilibrium

## Experiment 22 Rabbit 273 13 days

*Gross examination* There is heavier formation of bone and cartilage at this time but they bear the same relative position to each other as the previous experiment

*Microscopical examination* The appearance is similar but is in a slightly more advanced condition than in the previous experiment

## Experiment 23 Rabbit 273 15 days

*Gross examination* The bone appears to be completely regenerated up to the junction, from which place the bony cartilage-like mass extends up to the cartilage stump

over on to the cartilage for a short distance lying beneath the perichondrium. The cortical bone becomes thinner as it approaches the junction and gradually intermingles with the cancellous bone of the rib. The perichondrium present nothing abnormal at the junction but the cartilage cells are larger and have the columnar arrangement which is characteristic of an epiphysis.

The perichondrium and the periosteum are rather adherent at the junction, and after their removal a slight thickening is seen in that region. Upon microscopical examination of the perichondrium and the periosteum, after removal no definite particles of cortical bone can be found.

This part of the subject will be considered under the following three subdivisions:

(a) Regeneration of bone at the junction subperiosteal resection of bone from the chondrocostal junction toward the rib side.

(b) Regeneration of cartilage at the junction subperiosteal resection of cartilage from the junction toward the sternal side.

(c) Regeneration of bone and cartilage at the junction subperiosteal resection of cartilage and bone including the junction.

#### (a) REGENERATION OF BONE AT THE JUNCTION

**Method.** A piece of bone from one to two centimeters in length was removed subperiosteally at the chondrocostal junction. The operations were performed with the same technique as in the previous cases.

**Results.** In all of these experiments there was regeneration of bone as in the ordinary resection of the rib. As there is cartilage on one side and bone on the other it is necessary to give the microscopical findings to show the part each takes in the regeneration.

#### Experiment 12 Rabbit 380 5 days

**Gross examination.** The space between cartilage and bone is filled with blood clot.

**Microscopical examination.** The changes are practically the same as for the regular resection. There is no proliferation at the cartilage stump and the usual conditions are present at the angle of the periosteum and the bone. There is not quite so much cartilaginous proliferation from the periosteum as in Experiment 7.

#### Experiment 13 Rabbit 279 10 days

**Gross examination.** There is practically complete filling of the periosteal gutter with new tissue.

**Microscopical examination.** There are scattered areas of cartilage and osseous tissue which are quite irregular in distribution. It has been claimed that the callus is all ossified from the old bone but that such is not the case is shown by the fact that the osseous tissue near the periosteum is separated from the original bone by an intervening layer of cartilaginous and osseous tissue.

#### Experiment 14 Rabbit 277 15 days

**Gross examination.** The periosteal gutter appears to be filled with calcareous material.

**Microscopical examination.** No additional changes are noticed at this time except that there is some proliferation from the marrow and the cortex of the bone stump. There is also a slight growth of cartilage from the cartilage stump.

#### Experiment 15 Rabbit 279 25 days

**Gross examination.** There is complete regeneration of bone in the periosteal gutter.

**Microscopical examination.** The new tissue between the two ends is practically all osseous, and there is a beginning differentiation into the medulla and cortex. (The regeneration of the marrow will not be considered at this time.) The periosteum has assumed a normal appearance and relation to the cortex. Even at this advanced stage it is easy to distinguish the bone that has arisen from the periosteum from that which has originated from the cortex and medulla. At the place where the new bone meets the cartilage stump there is the appearance of normal chondrocostal junction.

**Conclusions.** In this series of experiments one is again impressed with the important part which the periosteum plays in the regeneration of bone. It is also noticed that there is very little tendency for the cartilage to grow over on to the periosteal bed.

#### (b) REGENERATION OF CARTILAGE AT THE JUNCTION

**Method.** A piece of cartilage from one to two centimeters in length was removed subperiosteally extending from the chondrocostal junction toward the sternum. On account of the form of the cartilage, it is sometimes impossible to separate it completely from the perichondrium.

**Results.** In the six experiments of this nature there was a different amount of cartilage regenerated according to the length of time that had elapsed. The results will be briefly given.

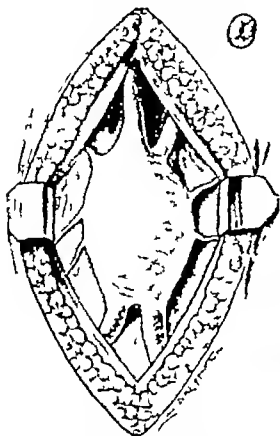


Fig. 7. A incision of the deep epigastric artery and vein.

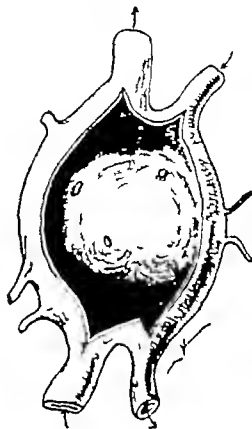


Fig. 8.

angeliorrhaphy and is to be preferred since it precludes recurrence and is rarely followed by gangrene.

In 105 extirpations for arteriovenous aneurism taken from Delbet, Monod and Vanvert, 99 cases were followed by recovery, four by death and two by gangrene, one case of gangrene being due to ligation for secondary hemorrhage.

Stewart (7) gives the following tabulation:

Ligation of the subclavian artery causes gangrene in 2 per cent of the cases (von Bergmann); axillary, 6.6 per cent; brachial, 18.6 per cent.

Ligation of the common femoral artery causes gangrene in 20 per cent of the cases (Baake); femoral artery and vein, 48.3 per cent (Ziegler); femoral artery and vein, 60 per cent (von Bergmann); popliteal artery,

54.5 per cent (von Bergmann); popliteal artery and vein, 100 per cent (von Bergmann).

The following report on the occurrence of arteriovenous aneurism was taken from Le Dentu and Delbet:

*In the foot.* Extremely rare. In 1895 only two cases could be found. Johnson's case reported by Cooper in which the aneurism occurred spontaneously in the internal malleolar vessel.

*Cadaver case* developed in the stump at the tibiotarsal articulation. A third case by Rhodes doubtful as to its identity.

*In the leg.* Not so rare. Often found in stumps. It occurs most frequently in the posterior tibial vessel.

Monod and Vanvert collected fourteen cases. Of these seven were in the posterior tibial vessels, two in the peroneal, one each in the posterior tibial artery and anterior tibial vein.

*Microscopic examination.* The new bone is denser than in the previous experiment although the cartilage is found to be in irregular patches.

#### Experiment 24. Rabbit 427 20 days

*Gross examination.* There is a complete regeneration of cartilage and bone the two tissues meeting at the chondrocostal junction at which place they form a bulging mass.

*Microscopic examination.* The bone is quite dense and is surrounded by a thin normal periosteum. The cartilage is likewise well formed and ends abruptly where the bone begins. Upon entering the place of union of the new bone and cartilage one is impressed with its similarity to the normal chondrocostal junction (Fig. 1). There is not the exact even appearance of the normal junction and the cartilage is not the regular columnar arrangement but it is possible that at this stage the balance of growth would be adjusted and there could be a still better approach to the normal.

*Conclusion.* From the last set of experiments and the two preceding groups one must conclude that the perichondrium and the periosteum are very important factors in the regeneration of cartilage and bone each determining the character of the tissue to be formed in its respective case.

The restoration of the chondrocostal junction is very important especially if it is to be considered as an epiphysis. The regeneration of the cartilage and bone at that place is affected mainly by the perichondrium and the periosteum and the establishment of a balance of growth are very interesting growth phenomena. Even if the chondrocostal junction in a restricted sense is to be considered as an epiphysis its restoration is all the more striking in view of the fact that the normal epiphysis is so susceptible to injury.

The perichondrium regenerates cartilage by a direct proliferation of its chondroblastic tissue into cartilage while the periosteum regenerates bone by an indirect proliferation of its osteoblastic tissue first forming cartilage which is then changed into osteoid tissue. From these sections there is considerable evidence that the cartilage can change directly into a bone cell and also that under certain conditions osseous tissue can change into cartilage by a direct retrogressive process in which the bone-cell changes directly into a

cartilage-cell. If all of these processes are possible then it is easy to conceive of a cycle of developmental changes by which cartilage can be changed into bone and bone transformed back to cartilage. When we consider the close relationship which exists between these two tissues it does not seem improbable that some such transformation may occur.

#### GENERAL SUMMARY

1. The periosteum is directly and actively concerned in the regeneration of bone. In the very early stages the periosteum proliferates to form a cartilaginous tissue which is later transformed into bone.

2. The exact method of the changes from cartilage to bone cannot be determined. There is considerable evidence in favor of the direct change of the cartilage-cell into the bone cell. There is at times the appearance of the osteoblast forming bone and substituting the cartilage. Therefore it seems as though both processes can take place at the same time.

3. The regeneration of bone also takes place from the marrow and cortical bone but to a more limited degree and at a later period than that from the periosteum.

4. The regeneration of cartilage takes place almost entirely from the perichondrium. It proceeds by a direct proliferation of all the layers of the perichondrium beneath the outer fibrous tissue. There is some evidence in favor of the view that the connective tissue is also transformed into cartilage under the stimulation of the neighboring cartilage or perichondrium.

5. There is a slight amount of regeneration of cartilage from the original cartilage near the perichondrium but the remainder of the cut end tends to undergo degenerative changes.

6. The extent of the removed cartilage exerts no influence on the regeneration. (There is no evidence of calcareous changes in the regenerated cartilage even as late as 40 days.)

(In closing I wish to express my thanks to Professor Doherty for his advice and suggestion during the performing of these experiments.)

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THE CLINICAL MANIFESTATIONS OF DISEASE OF THE GLANDS OF  
INTERNAL SECRETION IN GYNECOLOGICAL AND  
OBSTETRICAL PATIENTS\*BY ROBERT T. IRANK, A. M. M. D. NEW YORK CITY  
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## I. INTRODUCTION

THREE years ago I read a paper before this society dealing with "The Function of the Ovary." To day I propose to extend the discussion beyond the sexual tract because in the interim our knowledge concerning the intimate correlation between the gonad and the other organs of internal secretion has increased sufficiently to allow of at least a fragmentary survey of their interaction. The previous paper was confined to physiological observation gained in the laboratory, the theme of the present one concerns itself mainly with their clinical application in both health and disease.

Confusion exists in the literature dealing with the ductless glands, partly because apparently conflicting observations are recorded, partly because the attention of investigators has been necessarily focused upon the individual problem upon which they are engaged. The present study has resulted from an attempt to evolve a practical working plan applicable to the clinical investigation of gynecological and obstetrical cases which show derangements of the glands of internal secretion. Although future study may necessitate radical revision of many of the now expressed this outline may prove of use in gaining further knowledge.

It is more with the hope of pointing out method of standardizing our researches, of utilizing the clinical material to better advantage and consequently of attaining a clearer insight into this obscure hyper of medical science than with the design of contributing startling new facts, that I have undertaken the writing of this paper.

The weight of evidence acquired during these last years has emphasized the fact, previously known, that the glands of internal secretion (specifically the gonads or sex glands,

the thyroid, parathyroids, hypophysis or pituitary, pineal gland or epiphysis, adrenals and pancreas) form a connected chain and coordination of their interrelation or disturbance of mutual balance suffices to produce variations from the normal. Therefore symptoms produced by disease or by deliberate injury or removal of a given gland may manifest themselves by phenomena ascribable to one or more distant members of the chain likewise response to therapeutic measures, though apparently the direct result of effect produced upon a certain gland may really prove to be due to mediate action through other members of the group.

The huge and rapidly growing literature accessible in three recent painstaking and commendable works, those of Biedl, Faltz, and Swale Vincent. Therefore I may be pardoned in my choice of only such articles as have direct bearing upon the points requiring emphasis.

II THE GLANDS OF INTERNAL SECRETION  
REGARDED INDIVIDUALLY

In order to present to you, as clearly as is possible at least in outline the most essential and fundamental functions currently ascribed to each gland, I have drawn up an abstract in which each gland is considered as if separate and dissociated, from the others, though I am well aware that this arrangement is both arbitrary and open to criticism. With each gland as far as is possible the following points have been noted: 1. Is the gland essential for the continuance of life or health? 2. What symptoms are produced by excess? 3. What symptoms are produced by reduced or hypofunction? 4. Do the symptoms of partial or complete

Source: A. Lippincott's "Internal Secretion," Second Edition, 1913.  
FALTZ, W. "Die Erkrankungen der Blutscheidungsorgane," 1911.  
VINCENT, S. "Internal Secretion and the Ductless Glands," 1914.

removal of the gland correspond to the clinical symptoms of hypofunction? 5 Does re-placement or opotherapy act as a successful substitute for the gland? I have chosen this somewhat pedantic method as the only available means of avoiding the hopeless confusion into which the entire subject has been plunged by innumerable contradictory reports.

As the theory of disfunction (i. e. qualitative change in secretion) at present rests upon no foundation admitting of proof it has been deliberately excluded from this generalization. Wherever disturbances of the glands produce distinct and generally known symptom complexes, such complexes have been used to designate the effects, in preference to a more detailed description.

A *Hypophysis or pituitary gland*. Composed of anterior (glandular) middle (epithelial margin) and posterior or infundibular (nervous) portion.

1 The anterior lobe is essential to life (Cushing<sup>1</sup> denied by Horley<sup>4</sup>). The posterior and middle lobes are not essential. 2 *Hyperfunction* produces acromegalic symptoms in adults gigantism if developed before puberty. 3 *Hypofunction* (pressure on the infundibulum or stalk through which the secretion is supposed to reach the system, will produce this) in adults causes adiposity (if from tumor called Frohlich's syndrome) —dystrophia adiposito genitalis before puberty true dwarfism. 4 *Hypophysectomy* (complete removal of anterior and middle lobe or section of stalk) produces sluggishness, falling out of hair glycosuria emaciation, coma, death. 5 Anterior lobe extracts delay the fatal outcome, relieve the symptoms due to partial removal (Cushing). Posterior lobe extract (pituitrin) raises the blood pressure and causes contractions of the pregnant uterus, but does not ameliorate the vital symptoms.

B *Thyroid gland*. 1 Not absolutely essential to the continuance of life, removal followed by severe symptoms. 2 *Hyperfunction* causes Graves' disease. 3 *Hypofunc-*

tion in adults produces myxedema in infancy cretinism. 4 Removal produces Cachexia strumipriva. 5 Thyroid extract improves cretinism and relieves myxedema as long as the drug is exhibited.

C *Parathyroid glands*. 1 Probably essential to the continuance of life. 2 *Hyperfunction* has been said to cause osteomalacia and eclampsia proof wanting. 3 *Hypofunction* produces tetany in pregnancy. 4 Parathyroidectomy is followed by tetany. 5 Parathyroid extracts are claimed to ameliorate tetany symptoms, at least temporarily.

D *Thymus*. 1 Not essential to the continuance of life. 2 *Hyperfunction* (?) status thymicus and status thymicolymphaticus is so regularly accompanied by general hypoplasia of vascular system and other glands of internal secretion and by hyperplasia of the lymph glands, that the importance of the thymus change *per se* is questionable. 3 *Hypofunction* normally involutes between the 10th and the 15th years. 4 Thymectomy no influence in adults transient retardation of body growth in infancy. 5 Thymus extract effects questionable.

E *Adrenals* (cortex interrenal system mesodermal origin, rich in lipoids medulla chromaffin system, neuro-ectodermal origin, contains adrenalin). 1 Essential to the continuance of life. 2 *Hyperfunction* (cortical?) in adults, hypertenchois. In infancy precocious puberty, in utero feminine pseudohermaphroditism (?). 3 *Hypofunction* (especially medullary) Addison's disease marked aplasia in status thymicolymphaticus. 4 Adrenalectomy muscle weakness, apathy glycosuria, death in a few days. 5 Adrenalin and adrenal extracts from the entire gland do not prevent death.

F *Pancreas* (islands of Langerhans internal secretory acinous portion external secretion). 1 Essential to the continuance of life. 2 *Hyperfunction* unknown. 3 *Hypofunction* of island portion produces diabetes. 4 Pancreatectomy glycosuria, polyuria, emaciation and death. 5 Pancreas extracts ineffective. Recently Biedl asserts that

CONWAY: The Pituitary Body.  
HAGGARD and FISKELEY, Eds. V. Brit. M. J. 1911, 1, 20.  
FABRICIUS: Von Klin. Rundschau 1904, 27, 28.  
In recent years the thymus has been thought to play an important

role in osteoporosis; Foster. For abstract of the literature see M. O.  
Society Abstract M. J. 1911, 12, 675.  
BROOK: A. Journal of Medicine, 1911, 1, 360.

lymph (through which the pancreas secretion is supposed to be carried into the circulation) relieves symptoms of hypofunction.

C. *Pituitary gland epiphysis*. 1 Not essential to the continuance of life (Miedl, Tenet & Boese<sup>1</sup>). 2 Hyperfunction in adult obesity or cachexia ( ). In childhood no definite effect? 3 Hypofunction bodily and sexual precocity. 4 Pituitary gland extirpation in adults no effect (Miedl) (Larner & Boese<sup>2</sup>). rabbits, negative (Fol) ( ). cocks, premature maturity (Cristea) retarded development. 5 Extracts ( ).

H. *Thyroid (follicles corpus lutum Interstitial glands)*. 1 Not essential for the continuance of life. 2 Hyperfunction in adult menorrhagia. In childhood premature sexual development. 3 Hypofunction in adults amenorrhoea obesity (probably secondary) in childhood infantilism. 4 Thyroidectomy in adults artificial menopause in childhood eunuchoid habitus, genital atrophy, miter type (no human data). 5 The reports on ovarian extracts show no uniformity of result.

I. *Metabolism*. Each of the gland appears to have some influence on metabolism. The effects are too obscure as yet to permit of clear exposition. In the main metabolic activity is stimulated by the thyroid, the chromaffin system (adrenal medulla, brownish ganglia) and the posterior lobe of the hypophysis (extirpation reduces assimilation); the pancreas, the parathyroids, and the anterior lobe of the hypophysis decrease metabolic processes (Latta); 6 The activity of the adrenal cortex and ovary an doubtful. Carbohydrate assimilation depends largely upon the pancreas (glycogen) set free under the influence of the chromaffin system. The thyroid influences the protein changes. The regulation of oxidation, mineral salt etc. is largely a matter of speculation.

J. Our knowledge of bone growth (stimulation, retardation) and nerve influences (increased or decreased irritability, inhibition or stimulation of the vegetative system) are

likewise in too chaotic a state to permit of short exposition.

This bare outline of the most striking phenomena produced by each individual gland can hardly be a separate entity is greatly modified by the effects of their interaction (correlation) which may increase, decrease, or neutralize their individual action to such a degree as to escape analysis in the present state of our knowledge. As this paper concerns itself mainly with the genital sphere the sum of the action of the various ductless gland upon the organs of generation and, reversely, the effect produced by the gonads upon these same glands is of major importance. W. Blair Bell<sup>3</sup> has already attempted such a generalization.

It must be borne in mind that the genital tract reacts to all stimuli to which it is responsive in one of two ways. By an increase or by a decrease in function. On the other hand the influence of the gonads, when regarded from this somewhat artificial viewpoint, might be expected to be more complex because it may (at least in theory) influence each individual of the ductless chain, alone or in various combinations.

The genital tract in the present connection must be regarded as composed of not only the internal and external genitals, but also as embracing the secondary sex characters which include the breasts, the distinctive type of skeletal development (in male and female) the fat and hair distribution, larynx, and psyche. The bony structures are but little affected after puberty and, therefore, influences which in infancy produce striking deviations in dimensions, no longer do so after adult life has been reached.

### III. EFFECT PRODUCED BY DUCTLESS GLANDS OF THE FEMALE GENITAL TRACT

1. *Specific action*. Early involution of the thymus or de traction of the pituitary gland produce premature sex development (including early body growth and feminine skeletal dimensions). Early hyperplasia of the thymus gland causes a marked genital hypoplasia and persistent infantile proportions.

2. *Specific action*. Excessive action of the

<sup>1</sup> JOUR. A. PINEAU, p. 191.

<sup>2</sup> EXNER, A. and TENET, J. *Deutsche Zeitschr. f. Klin. Med.* 1911, 115, 33.

<sup>3</sup> FOL, C. *Arch. Sci. Biol.* 1911, 1, 33.

<sup>4</sup> CRISTEA, C. *Monatsh. med. Naturgesch.* 1911, 1, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

adrenal cortex may produce premature sex development. More regularly it causes excessive hair growth (often of the male type) and genital hypoplasia. 3 *Non specific action* The effect of either hyperfunction or hypofunction of the thyroid and hypophysis is less specific both are eventually followed by reduced development and function of the genital tract (though often preceded by transitory stimulation. 4 *Indifferent action* The parathyroid and pancreas produce no changes. 5 *Ovarian effects* Tumors of the ovary *per se* may cause early sex maturity which may regress after removal of tumor."

IV EFFECTS PRODUCED BY THE GONADS  
ON OTHER DUCTLESS GLANDS

The most unequivocal effects are obtained by castration. The hypophysis increases in size (anterior lobe, eosinophiles more numerous, adiposity long extremities). The thyroid shows accumulation of colloid in rabbits (Bell) in the human it may be atrophic. The adrenal cortex becomes hyperplastic (increased sensitivity to adrenalin). The pancreas remains unchanged (Rebaudi claims that the Langerhans islets hypertrophy). The pineal gland hypertrophies. The thymus may persist unduly. The parathyroid are unaffected.

The general systemic effects of castration can be explained only in part by these numerous changes.

In infancy in addition to the failure of genital development referable directly to the ovary, the unchord type appears (hypopharynx). Other changes are still largely a matter of conjecture. The effect of a true non-chorionic metabolism is unsettled to warrant serious discussion. Old and doubtful experiments are quoted with unifying regularity. Complete revision of the subject is urgently needed. No exclusive value of the

effect of ovarian hypersecretion, except upon the genital tract, is available.

All that has preceded has served mainly to illustrate the complicated interrelation existing between the various members of the ductless chain. But as the changes which take place in the genital tract originate either directly in the ovary or are transmitted through this organ, the mechanism by means of which the gonad performs its function requires detailed study. In the present state of our knowledge the following appear true:

#### V LOCAL GENITAL FUNCTION OF THE OVARY—PHYSIOLOGICAL

The ovary cannot be regarded as a simple or homogeneous organ. Functionally it contains different elements which appear to have different properties. The constituents of the ovary are the follicle apparatus, the interstitial gland and the corpus luteum.

## 1 THE POLICE APPARATUS

*The primordial ova.* The primordial ova (germ cells) most probably are direct descendants of the earliest division of the fertilized ovum (blastomeres). They reach the anlage of the ovary by wandering through mesentery (Fuss) and are here surrounded by the so called germinal epithelium a derivative of the lining of the coelum thus forming *primordial follicles*. Even during intra uterine life a limited number of primordial follicles develop into granular follicles and Runge reports a corpus albicans ( ) in an infant two years of age.

A castration in the young animal invariably is followed not only by atrophy of the internal and external genital but also by the cessation of development of the hair and changes in the secondary sex characters (eunuchoid type) the normal development of these structures and qualities must either directly or indirectly be ascribed to the follicular apparatus the corpus luteum being absent at this stage—unless the action of the interstitial gland (*vide infra*) governs their growth.

[illegible]

Puberty is ushered in by a mighty acceleration of follicular ripening. The impulse for this change may be inaugurated by removal of the inhibitory action of the thymus and pineal gland which involute at this period.

Whether the onset of the first menstruation is preceded by ovulation has not been settled. This mooted question can be decided only by occasional observations made at the autopsy table or at operation. The theoretical and practical importance of this question will become more apparent during the discussion of the relation of menstruation to ovulation.

The subsequent fate of ripe ova which are extruded from the ovary become fertilized and develop in the uterus, does not concern us in this discussion except in so far as the placenta is regarded as a gland of internal secretion by some (*vide infra*).

## 2. THE INTERSTITIAL GLAND

In a considerable number of mammals (about 50 per cent of those examined) complements of large epithelioid cells are found in the stroma of the ovary (Anna Schaefer<sup>10</sup>). Genetically Lane Claypon<sup>11</sup> derives them from the germinal epithelium (rat, rabbit) others have ascribed their origin to the stroma cells forming the theca interna of atretic follicles (Limon<sup>12</sup> etc). In the human species the interstitial gland when present, is but slightly developed. According to Wallert<sup>13</sup> and Seltz,<sup>14</sup> it is most prominent during pregnancy (from the third month on).

The only well-developed interstitial gland encountered by me during ten years of search for this structure was obtained from the ovary of young virgin (23 years) suffering from dysmenorrhea and fibroids (Figs. 1 and 2).

The cells of the interstitial gland resemble those of the corpus luteum containing similar lipid granules.

As it has proved impossible by the most diverse experiments (X-ray transplantation, etc.) to destroy only the follicular appa-

ratus or the interstitial cells, without injury to the other the question as to which of these two systems controls the growth and continued nutrition of the uterus is still unsettled.

The one observation recorded by Bucura<sup>15</sup> in which minute remnant of the ovary of rabbit sufficed to maintain uterine nutrition, the remnant examined in serial sections showing only a few follicles but no interstitial cells, cannot be considered decisive without additional corroboration.

On the one hand, the fact that the follicular apparatus is constant in all species and shows distinct and traceable relations to the functional condition of the genitals (puberty, estrus, pregnancy, climax) speaks for its functional importance on the other the inconstant occurrence of the interstitial gland (Schaefer<sup>10</sup>, Frankel<sup>16</sup>) in different, often related species, and its apparent lack of correlation with functional states of the uterus (denied by Regaud et Dehrell<sup>17</sup>) make any important function doubtful. The most weighty arguments in fa or of the importance of the interstitial gland are purely morphological on the one hand is its supposed analogy to the interstitial cells of the testis (?) on the other the similarity of granulosa and theca lutein cells (*vide infra*).

## 3. THE CORPUS LUTEUM

This transitory structure which is a derivative of the follicle apparatus, now generally included among the glands of internal secretion, forms within the follicular cavity after the ripe ovum has been extruded. The corpus luteum is regularly found in all species of mammals, and occurs in pregnancy in all animals which harbor their young in the uterus. Its derivation from the epithelial cells lining the follicle (granulosa cells) is now generally conceded. The minutest details of the formation of the corpus luteum in the mouse rabbit (Sohota<sup>18</sup>) guinea pig (L.

BUCHURA, E. Zacher J. Hüllenkörper 1907, p. 127, (C. F. v. der Ahr, J. Clar). In this work the author also suggests that the pars interna may develop an independent internal secretion.

FRANKEL, L. Arch. f. Gynäk. 1907, h. 443 concludes that the interstitial gland cannot be correlated with any genital or important function.

REGAUD, C. et DEHRELL, G. Compt. rend. Soc. Biol. 1906, p. 243, showing research and sex activity anterior and posterior to the interstitial gland. Zbl. 1906, h. 17. The interstitial gland has no relation to estrus.

SCHOTA, J. Anat. Anz. 1911, p. 472.

BRANDER, A. Arch. f. Gynäk. 1911, h. 497.  
LANE CLAYTON, Proc. Roy. Soc. Med. Series B, 1907, h. 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

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SELTZ, L. Arch. f. Gynäk. 1906, h. 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476,



cross section, especially toward the end of this stage the central coagulum may be firmer and a well-defined yellowish brown crenated margin (the lutein edge) may surround the clot. Not infrequently the center of the corpus luteum is cystic (Fig 4). *Microscopically* this stage is the one hitherto described as typical of the corpus luteum the two previous stages having been generally overlooked in the human subject. The theca interna is barely definable from the externa. The large theca lutein cells have been crowded apart or have disappeared. They remain visible only in the bases of the larger septa which penetrate the lutein (granulosa) margin (Fig 10). The lutein cells have assumed a predominant place. Their increase in size and number causes the infolding of crenation characteristic of the lutein edge. The cells are uniform irregularly cuboidal pale with light spherical nuclei. The cell bodies contain lipid granules and lutein (Miller<sup>20</sup>). Between the cells running toward the central coagulum are innumerable straight fine capillaries, accompanied by a few spindle cells. When these spindle-cells reach the coagulum, some spread along the surface of the epithelium, and others spread into the clot (Fig 11). Toward the end of this period the capillary network is more prominent. Connective tissue septa spread from the theca interna toward the centrum to meet other septa which arise from the connective tissue which has proliferated in the clot. This central connective tissue has firmly roofed off the lutein cells from the clot which by this time is increasingly organized.

d. *Period of regression* *Macroscopically* the corpus luteum looks paler. On cross section the centrum is more solid and colorless instead of this the center may remain cystic. The crenated margin is of brighter yellow color broad and well defined. *Microscopically* the fibrous septa are firm, the capillaries narrowed the lutein cells smaller vacuolated irregularly stained, or deficient (gaps). The central core is fibrous (Fig 5). Special stains show neutral fat in the lutein cells (Miller<sup>20</sup>). *Final stage of regression* The further fibrous changes which eventually produce the *corpus albicans* are of no importance in this connec-

tion. They consist mainly in an overgrowth of connective tissue and disappearance of the lutein cells and capillaries. As final regression may extend over six or more weeks, it is not uncommon to find two four or more corpora lutea in various stages of regression of the ovaries.

e. *Corpus luteum of pregnancy* *Macroscopically* it is often larger than the corpus luteum of menstruation but it cannot be differentiated from it with any degree of certainty. *Microscopically* after the sixth or eighth week the regular arrangement of the capillary network and septa are well defined (Fig 13). According to Miller considerable accumulation of colloid in the lutein cells (van Gieson's stain) is characteristic also an irregularly distributed deposit of calcium salts (Fig 14). Fat in large quantities is absent at all times, according to Miller regression (during the puerperium) taking place by necrosis.

#### 4. SUBSIDIARY CHANGES IN THE OVARY

A. *Follicle atresia* At any stage of development, the primordial or granular follicle may degenerate (Fig 15). Normally this process is ushered in by the disappearance of the epithelium (granulosa) absorption of the follicular fluid, and collapse of the vesicle. The connective tissue of the thecal layers grows outward into the ovarian stroma, destroying the marginal definition of the follicle. Most characteristic is the broadening and hyaline change of the fine, almost invisible layer of connective tissue which separates the granulosa cells from the theca lutein cells. Fine bodies of fibrillae also enter the follicle cavity and organize within it (Fig 17). Especially in pregnancy (Waller<sup>21</sup>, Setz<sup>22</sup>) the process of atresia is accompanied by well marked lutein changes in the thecal cells (theca lutein) thus forming what these authors call the interstitial gland in the human female.

The degenerating connective tissue may form broad homogeneous bands (hyaline staining red with van Gieson) either within or without the atretic follicle with resultant bizarre figures (Fig 18). Large atretic follicles are usually indistinguishable, to the naked eye, from ripe follicles.

Still more recently R. Meyer<sup>21</sup> has described variations in follicular atresia which, unless borne in mind, may lead to confusion. As our knowledge increases, these variations may assume significance in pathology.

**B Accessory lutein formation in atretic follicles.** The atresia is indicated by the cardinal signs (partial destruction of the granulosa) by a well defined hyaline change in the connective tissue separating granulosa from the theca lutein cells, and by the irregular size and grouping of these thecal cells. A portion of the granulosa cells (one-twentieth to one-fourth of the periphery) are changed into true lutein cells, and show a stage of development (proliferation, vascularization, ripeness, or regression) corresponding exactly to that of the true corpus luteum which is coincidentally present in one of the ovaries. This accessory lutein formation may be especially marked during pregnancy.

**C Theca lutein proliferation in atretic follicles during pregnancy in hydatid mole and chorio epithelioma.** Either with or without the granulosa lutein changes just described, the theca-lutein cells of atretic follicles may be unusually prominent and well developed. The fibrillar connective tissue may penetrate the thecal cells in all directions; the hyaline band is never lacking. In hydatid mole and chorio epithelioma the great increase in theca lutein cells, combined with distention of the cavity of atretic follicles, produces the typical lutein-cystic ovaries which may assume tumor-like proportions (Findley<sup>22</sup>) but these ovarian pseudo-tumors may regress after the uterus is emptied or removed (Fraenkel<sup>23</sup>).

##### 5 CORRELATION OF OVULATION AND MENSTRUATION

The foregoing description appears to set at rest the long mooted question as to the genesis of the corpus luteum. A further advance has been made by correlating these various stages with cyclical changes in the uterus, described many years ago by Kundrath and Engelmann<sup>24</sup> and rediscovered and

popularized by Hitschmann and Adler<sup>25</sup>. Meyer and Ruge, Schroeder and also Fraenkel<sup>26</sup> and Miller differ somewhat in their interpretation of the time relation existing between ovulation and menstruation. They all agree however that a distinct relation between these processes can be recognized. That such relationship exists — as was long since pointed out by Fraenkel<sup>26</sup> but repeatedly denied by Leopold and Miranoff<sup>27</sup> and Leopold and Ravano<sup>28</sup> and others — can no longer be disputed. The discrepancies arose because observations made at operation are misleading, as the just-ruptured follicles are readily overlooked, and the formed corpus luteum does not permit the operator to differentiate between earlier stages, periods of ripeness, or even of beginning regression.

Hitschmann and Adler as will be recalled, divided the changes taking place in the uterus into four periods: (1) Post menstrual (regressive two to three days after the menses) (2) Interval (resting and early proliferative third to eighteenth day) (3) premenstrual (marked glandular activity eighteenth to twenty fifth day), (4) menstrual (bleeding and deturgescence). As I have pointed out,<sup>29</sup> this subdivision though undoubtedly correct, is not always demonstrable because, on the one hand the post menstruum merges closely into the interval, and on the other the interval is often indistinguishable from the early premenstruum. Different portions of the uterine mucosa, moreover may differ showing some variations in different areas.

The following table shows the different views held by Meyer and Ruge, Schroeder and Miller.

Accordingly we see that both Meyer and Ruge, and Schroeder believe that ovulation takes place within fourteen days of the onset of the last menses.<sup>30</sup> Miller basing his views

FINDLEY, F. and ADLER, J. *Monographs of Gynecology* (Gynäk. monogr.) 1908. Described the cyclical changes as I showed that most of the so-called "menstrual" cases were normal menstruation.

FRAENKEL, L. *Zentralblatt Gynäk.* 1907, 1908, 1909.

FRAENKEL, L. *Arch. f. Gynäk.* 1909, 1910, 1911, 1912.

LEOPOLD, G. and MIRANOFF, M. *Arch. f. Gynäk.* 1904, 1905, 1906.

LEOPOLD, G. and RAVANO, A. *Arch. f. Gynäk.* 1907, 1908, 1909, 1910.

FRANK, T. N. Y. M. J. 1911, 1912, 1913, 1914.

The difference between Schroeder and Meyer and Ruge is more apparent than real. For Schroeder's earliest stage (Plate I) corresponds to the late vascularization period of Meyer.

In two of my own cases I found corpus luteum in the earliest vascularized stage on the last day of menstruation.

FINDLEY, F. *Am. J. M. Sc.* 1904, 1905, 1906. In cases of hydatid mole, the corpus luteum is absent.

FRAENKEL, L. *Monographs of Gynecology* 1908. Described the cyclical changes as I showed that most of the so-called "menstrual" cases were normal menstruation.

LEOPOLD, G. and MIRANOFF, M. *Arch. f. Gynäk.* 1904, 1905, 1906.

LEOPOLD, G. and RAVANO, A. *Arch. f. Gynäk.* 1907, 1908, 1909, 1910.

FRANK, T. N. Y. M. J. 1911, 1912, 1913, 1914.

Corpus Luteum	Uterine Mucosa	Days from Onset of Last Menstruation		
		Meyer and Ruge	Wanderer	McDerm
First follicle Corpus luteum beginning	Menstruation beginning	Days	14 days	14 days
Maximum development of follicle	Menstruation	14 days	20 days	20 days
First menstruation	Menstruation	14 days	20 days	20 days
Second menstruation	Menstruation	14 days	20 days	20 days
Third menstruation	Menstruation	14 days	20 days	20 days

partly on theoretical considerations, partly on discrepancies he finds in Meyer and Ruge's papers, but mainly upon the purely macroscopic (operative) findings of Fraenkel concludes that ovulation occurs on the eighteenth day in women with a four weekly cycle on the eleventh in those with a three-weekly cycle.

A Practical importance of determining the date of ovulation. Miller correctly suggests that the exact determination of the time of ovulation has an important bearing on the success of artificial insemination. Although this procedure has not as yet attained much importance in gynecology and obstetrics, it has long ago proved of economic value among animal breeders who distribute the semen of valuable stallions, or impregnate refractory females of various species, by these means. Rohleder<sup>17</sup> who has collected the literature bearing on human artificial insemination, and Hirsch<sup>18</sup> both place the optimum time as immediately after the period, or in exceptional cases during the last day of menstruation. The knowledge of the exact date of ovulation would also prove of value in assisting fertilization, by regular coitus, in cases of "relative sterility."

B Duration of pregnancy. The exact time of ovulation would prove of greater importance in determining more exactly the time of fertilization in normal pregnancy. This would obviate to a degree the present annoying uncertainty familiar to the obstetrician,

which prevents him from predicting the time of labor with any degree of certitude unless the current conclusion that the duration of pregnancy is not determinate (270 to 300 days) proves true. The importance in medical practice need not be emphasized.

In this connection the attempt of Bryce and Teacher<sup>19</sup> to determine the date of fertilization by means of the leaven yeast on a recorded in the literature is of interest. The data at their disposal is, however not unimpeachable. From their table it appears that fertilization may take place at any time between the fifth and the twenty-fifth day after the onset of the menses. Ovulation supposedly takes place approximately twenty-four hours before the start (in Keibel and Hall's Handbook<sup>20</sup> basing his deductions upon the large statistics of Thiel<sup>21</sup> Sumner<sup>22</sup> and others, and upon a large series of embryos, concludes that impregnation usually takes place within the first week following menstruation.

Evidently in the present state of our knowledge, we are as yet justified in concluding merely that ovulation follows menstruation and that the fertilized ovum dates from before the menses period.

In order to clear up this much disputed point, future investigators must state definitely in their reports the type of cycle (three- or four-weekly) and the duration of the period (one to seven or more days) and should not fail to put on record all cases in which pregnancy can be traced to a single coitus of which the date and relation to the menstrual period is known.

In view of these newer requirements, allow me to repeat and amplify the conclusions deduced in my previous paper concerning—

## 6. THE PHYSIOLOGICAL SIGNIFICANCE OF THE GENITAL FUNCTION OF THE OVARY—SUMMARY

A. Puberty conditions. 1. In infancy and childhood the follicle system (perhaps also the interstitial gland as represented in

BRYCE, T. H. and TEACHER, J. H. Contributions to the study of the early development and maturation of the human ovum. April 1904, p. 25.

KEIBEL, F. and HALL, H. Handbuch der Entwicklungsphysiologie des Menschen. 1904, p. 25. 2. In the case of the ovum, with data of impregnation, the average duration is 14 to 17 days.

KEIBEL, F. and HALL, H. Handbuch der Entwicklungsphysiologie des Menschen. 1904, p. 25. 3. In the case of the ovum, with data of impregnation, the average duration is 14 to 17 days.

KEIBEL, F. and HALL, H. Handbuch der Entwicklungsphysiologie des Menschen. 1904, p. 25. 4. In the case of the ovum, with data of impregnation, the average duration is 14 to 17 days.

KEIBEL, F. and HALL, H. Handbuch der Entwicklungsphysiologie des Menschen. 1904, p. 25. 5. In the case of the ovum, with data of impregnation, the average duration is 14 to 17 days.

KEIBEL, F. and HALL, H. Handbuch der Entwicklungsphysiologie des Menschen. 1904, p. 25. 6. In the case of the ovum, with data of impregnation, the average duration is 14 to 17 days.

KEIBEL, F. and HALL, H. Handbuch der Entwicklungsphysiologie des Menschen. 1904, p. 25. 7. In the case of the ovum, with data of impregnation, the average duration is 14 to 17 days.

the human beings by the theca luteum cells of atretic follicles, (Wallert, Biedl and others)) governs the growth and development of the internal and external genitalia.

**B Cyclical conditions** 2 At puberty ovulation takes place the corpus luteum secretion sensitizes the uterus, which therefore undergoes the premenstrual cyclical change, which terminates with menstruation<sup>10</sup> (at the time the corpus luteum regresses and loses its secretory activity i. e. its power to inhibit menstruation (L. Loeb<sup>11</sup>)). 3 As soon as the corpus luteum becomes inactive a new follicle begins to ripen, in time ruptures and again forms a corpus luteum.

**C. Pregnancy conditions** 4 If after ovulation, the escaped ovum is fertilized and reaches the uterus, which by this time is sensitized by the corpus luteum and therefore, is ready to respond by decidua formation (maternal placenta of L. Loeb<sup>12</sup>) nidation or embedding takes place. 5 The stimulus exerted by the products of conception in turn react upon the corpus luteum and protract its period of activity to the termination of pregnancy (R. Meyer) entailing inhibition of further follicle ripening and ovulation throughout pregnancy (Fraenkel, Loeb<sup>13</sup>).

**D Climacteric conditions** 6 As the result of lessened functional activity (whether local ovarian secondary to other glands of internal secretion in some cases, perhaps as the result of consumption of all the ova) if follicle ripening terminates, no corpora lutea are formed and menstruation ultimately ceases.

**L. Accidental conditions** 7 Operative removal of the corpus luteum disturbs the menstrual cycle. If the ripe follicle or the early corpus luteum is ablated menstruation is delayed (Fraenkel<sup>14</sup>) by the time required for the new follicle to ripen, rupture and form

a corpus luteum. 8 Operative removal of a fully developed corpus luteum (which has already produced sufficient premenstrual change in the uterine mucosa) causes an earlier appearance of the menses (Vertes<sup>15</sup>). 9 Operative removal of the corpus luteum in the early weeks of pregnancy (probably second to sixth or eighth week) produces abortion or absorption of the products of conception (Fraenkel, L. Loeb<sup>16</sup>). Considerable literature has accumulated pointing to the fact that in human beings pregnancy may continue after removal of the corpus luteum<sup>17</sup>.

**F Lactation** The condition of the ovaries during lactation amenorrhea, and lactation atrophy of the uterus, is practically unknown. It should be the task of every gynecologist and pathologist to record the gross appearance of the ovaries and the presence or absence of a recent corpus luteum in all such instances available. Whenever possible, both uterus and ovaries should be submitted to microscopic examination.

Ovulation in most animals takes place immediately post partum. It may do so in the human being and conception is possible under these circumstances (conception four days post partum (Kronig<sup>18</sup>)). Fertility during lactation amenorrhea is reduced especially in the earlier months (Weinberg<sup>19</sup>). Permanent

After O. Gynäk. Rundschau, 1912, vi, 266. Records of cases in which ovulation was performed more than 10 days after the onset of the menses; the next menstruation occurred earlier if before the sixth day menstruation was postponed. The ovulation was again in pregnancy 1 week 12 months for three children.

Loeb (see vi) has shown the failure of ovulation by the fact that the uterus would not react on 1 hour the maternal portion of the placenta after the corpus luteum has been removed.

See M. Zanderl, Gynäk. 1911, xiv, 227.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230 and 231.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Occasional reports of amenorrhea after complete removal of both ovaries are not convincing. If the oophorectomy performed for an inflammatory disease, amenorrhea may be left behind; amenorrhea may be present and have reported cases with three ovaries (Kronig).

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230. In other cases the third ovary might have been overlooked. In the majority of cases, amenorrhea is not observed. All is found in the article by Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230. Three cases of amenorrhea after oophorectomy.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230. Amenorrhea is observed before an ovum. It is found that the next ovum occurred at an earlier date. In ovum before and not the pregnancy induced the growth of other follicles.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

Loeb, Gynäk. 1911, xiv, 227, 228, 229, 230.

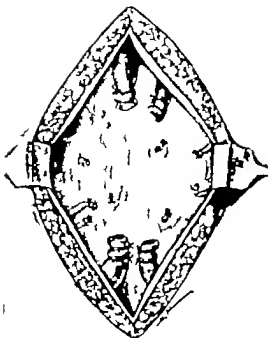


Fig. 9

Gross and Sencert have observed one case that followed fracture of the limb. In thirteen cases extirpation was successful. In one case extirpation was done. Infection set in, gangrene followed, the limb was amputated, and the case recovered. Physick ligated the femoral vessels in a case which resulted in gangrene and death. Nicolaysen cured one case by ligating the posterior tibial vessels and the peroneal artery.

Annandale and Maydl cured one case by incision of the sac. One case was treated by gal and puncture without success.

*In the popliteal space.* Not very rare. In 1889 Le Dentu and Delbet collected 22 cases, two of spontaneous origin, one from rupture of an arterial aneurysm into a vein, the other by exostosis; all the other were of traumatic origin.

Monod and Vanverts collected 35 cases recently, and in every case of which the etiology was known, it was of traumatic origin usually caused by bullet or stab wounds. The branches of the popliteal vessels are most frequently affected; the tumor usually attains a large size and the veins of the limb are extremely dilated.

Trophic disturbances are common, and ulcers are frequent. The edema sometimes is enormous. In some cases there is violent pain due to pressure on the sciatic and the internal popliteal nerves. It is a serious condition and requires prompt treatment. Compression has been tried in all its forms without success. It is, however, of some service preparatory to an operation as it lessens the edema, favors the nutrition, and the healing of ulcers. Extirpation is actually the best method of treatment, although bad results may follow such as gangrene and functional disturbances.

*In the superficial femoral vessels.* This is now among the most frequent of all forms. Le Dentu and Delbet collected 34 cases in 1895. Monod and Vanverts have collected 35 cases since. Most cases in this region are of traumatic origin. Berry reported a case of spontaneous origin. These cases should be treated promptly as edema, engorgement, and ulceration are usually present. Double ligation with extirpation has given the best results.

*In the root of the thigh.* Almost as frequent as in the femoral vessels, bullet and stab wounds being the usual causes.

In 1889 Le Dentu and Delbet collected 26 cases. Monod and Vanverts have collected 23 cases since. The symptoms are the usual, but treatment of these cases is most delicate. Ligation by the method of Danell and by that of Hunter before 1889 gave the most disastrous results. Out of 11 cases, 9 died, and 2 were cured by ligation of the artery and vein. The double ligation has usually been successful, but extirpation is the method of choice. Practically this method has been successful in all 12 cases reported the last twenty years.

*In the iliac vessels.* This is extremely rare and unless treated immediately is almost always fatal. Three cases of the internal iliac have been found but all ancient. Laney's case is somewhat doubtful. Crisp's case was a diffuse aneurysm. Bergmann's case was gangrenous and had to be amputated.

*In the common iliac.* It is still more rare; only two cases are on record. Extirpation is probably the best treatment in these cases, after the sac is found.

Schickel<sup>16</sup> takes the view that the ovaries are inactive in many cases of menorrhagia and metrorrhagia. Such cases, however, judging by my experience must not only be exceptional, but are characterized by other symptoms, which assist in their differentiation.<sup>17</sup> A case of almost continuous uterine bleeding throughout many years, accompanied by abnormal increase in fertility, is of interest in this connection.<sup>18</sup>

Here also purely secretory changes or minute variations in follicle ripening corpus luteum formation and follicle atresia (interstitial gland) as yet not to be detected, may be the cause.

### B Hypofunction

1. *Amenorrhoeas* Sharply to be distinguished from the true varieties of genital aplasia with amenorrhoea are those cases of amenorrhoea in which ovulation must persist (at least in some modified form) because pregnancy takes place.<sup>19</sup> This may occur in extreme youth, before the onset of menstruation (see Lens<sup>20</sup>) or in later life as the following case demonstrates.

A striking instance of this class was an Italian woman of 8. Her first menstruation occurred in her nineteenth year. She married at 20 and had children. The second menstruation took place at 5. Her second child was born two years later. Although she menstruated only twice no blood menses, either general or local could be found. In type she was feminine. Her mother menstruated three times during her whole life.

Similar cases are reported in the literature.<sup>21</sup>

b *Amenorrhoea and atrophy of uterus* The finer anatomic changes in the ovaries and

uterus which accompany and produce the genital aplasia and hypofunction due to wasting systemic diseases, such as tuberculous diseases of the glands of internal secretion such as acromegaly hyperthyroidism or hypothyroidism Addison's disease and simple (?) obesity (*Maiselstruck*) have not been studied so far as I am aware.

c *Infantilism and amenorrhoea* Herrmann<sup>22</sup> reports that in genital aplasia due to status lymphaticus the ovaries are enlarged in 58 per cent of the cases, and show microcytic changes thickened albuginea increase of the ovarian stroma, and diminution of the primordial follicles. The systemic changes characteristic of infantilism and status lymphaticus were present. They require no special mention here.

d *Sterility* Sterility *per se* certainly is a hypofunctional condition of the genitals because the main *raison d'être* for this tract is the function of reproduction. Reynolds<sup>23</sup> has treated this subject exhaustively. The sterilities due to mechanical factors require no discussion in this paper.

In regard to fecundity women may be divided into four types—the abnormally fertile the normally fertile the transiently sterile the permanently sterile.

The abnormally fertile not only conceive readily and frequently but also show a marked tendency to multiple pregnancies.<sup>24</sup> The ovaries evidently ovulate regularly or more frequently and prolifically than normal, but, likewise the facilities for nidation must be exceptionally good. Anatomically no distinctive marks are known.

The normal physiological type requires no further consideration.

The transiently sterile may be subdivided into two groups. The first shows no abnormality except a small flaccid uterus. In this class belong lactation atrophies and atrophy secondary to systemic disease or obesity. Surprising improvement may occur within the course of a short period of time and subsequent pregnancy is by no means uncommon. The second class, which includes milder degrees of infantilism (short vagina, shallow

<sup>16</sup>SCHICKEL O. and KELLER R. Arch. f. Gynäk. 1911, 107, 361. Case no. 22 with uterine hypofunction and atrophy of ovaries. The uterus was small, the ovaries were small, the uterus was small, the ovaries were small. These cases are perhaps due to ovarian hypofunction, but they have very small cases. No connection of the ovaries of such cases has been made.

<sup>17</sup>BRUNER B. Zentralbl. f. Gynäk. 1911, 37, 371. The patient was 5 years old. Her mother began at 9 years and bleeding continued without menstruation for 10 years. No connection of the ovaries of such cases has been made. The uterus was small, the ovaries were small, the uterus was small, the ovaries were small. These cases are perhaps due to ovarian hypofunction, but they have very small cases. No connection of the ovaries of such cases has been made.

<sup>18</sup>BRUNER B. Zentralbl. f. Gynäk. 1911, 37, 371. The patient was 5 years old. Her mother began at 9 years and bleeding continued without menstruation for 10 years. No connection of the ovaries of such cases has been made. The uterus was small, the ovaries were small, the uterus was small, the ovaries were small. These cases are perhaps due to ovarian hypofunction, but they have very small cases. No connection of the ovaries of such cases has been made.

<sup>19</sup>BRUNER B. Zentralbl. f. Gynäk. 1911, 37, 371. The patient was 5 years old. Her mother began at 9 years and bleeding continued without menstruation for 10 years. No connection of the ovaries of such cases has been made. The uterus was small, the ovaries were small, the uterus was small, the ovaries were small. These cases are perhaps due to ovarian hypofunction, but they have very small cases. No connection of the ovaries of such cases has been made.

HERRMANN E. Zentralbl. f. Physiol. 1909, 100, 361.  
REYNOLDS E. J. Am. M. Ass. 1911, 16, 95.

amenorrhea has been known to occur (Thorn<sup>9</sup>). The causes which actuate the breast are in dispute<sup>10</sup> and reversely the means by which lactation reacts on the genital sphere are also not understood.

## VI. LOCAL GENITAL FUNCTION OF THE OVARY. PATHOLOGICAL

The previous discussion has dealt in the main with the morphology and function of the ovary under normal condition although some types of lactation atrophies verge perilously close to the abnormal. In what follows an attempt will be made to treat of the same topics in disease. On account of absence of reliable data our knowledge is most incomplete.

### 1. INFLAMMATORY CHANGES

A. *Acute*. The graver type of lesions such as acute inflammatory involvement of the ovary (almost invariably accompanied in inflammation of the tube and often of the uterus and pelvic connective tissues) may not interfere with the regularity of the cyclical phenomena. Usually menstruation is more profuse (perhaps purely local congestion and tasks). Frequently prolonged or irregular menstruation occurs. Data are wanting to show whether this is due to changes in the periodicity of ovulation or in irregularity in the formation and persistence of the corpus luteum.

B. *Chronic inflammatory lesions of the ovary*. Chronic inflammatory lesions of the ovary show similar variations. The wonderful resourcefulness of a nature is demonstrated in advanced destructive processes, in which a minute remnant of functioning ovarian tissue suffices to continue the periodic genital function either normally or with some variations.

When such variations do occur they usually take the form of hyperfunction as is demonstrated not only by the accompanying menorrhagias and metrorrhagias, but by the hyperplastic conditions of the endometrium (which must be considered secondary to ovarian

overactivity in those cases in which no signs of inflammation can be demonstrated). The macroscopic and microscopic appearance of the ovaries, aside from the evidences of inflammation is so varying that no safe deductions can be drawn. Until a clearer conception of the normal processes is at our disposal, small hope of clarifying this perplexing problem can be entertained.

The importance of a thickened albuginea and microscopic degeneration of the ovaries in this connection need not be seriously considered (except in their relation to functional sterility—in the inflammatory type of cases the sterility is mechanical primarily due to gross tubal lesions) because it will be shown later scanty and infrequent menstruation is the characteristic of this ovarian change.

### 2. FUNCTIONAL DISTURBANCES

#### A. *Hyperfunction*

a. *Metric type*. Clinically often indistinguishable from inflammatory conditions are those of persistent menorrhagias and metrorrhagias for which no sufficient anatomical basis can be found. The gap between this pure type of functional disturbance and the inflammatory varieties is bridged by the numerous cases in which a much thickened uterine wall is encountered—the metritic changes emphasized by Theilhaber.<sup>11</sup> The explanations offered by this and other authors are not the sole ones possible because age changes, repeated childbirths, or continued ovarian hypersecretion may just as logically account for the connective tissue increase, the sclerosed vessel (Lindley<sup>12</sup>) the muscle change (Amplatz<sup>13</sup>) etc.

b. *Type without anatomical basis*. Such explanation certainly does not apply to the rarer cases in which both uterus and ovaries are absolutely normal, as appeared to be the case in two instances in which I subjected these organs to the most thorough and complete microscopic examination. The supposed ovarian changes reported by Kaji<sup>14</sup> have not stood the test of serious criticism.<sup>15</sup>

THEILHABER, A. *Monatsh. u. Arch. f. Gyn. u. Obst.* 1906, 40, 1.  
LINDLEY, M. M. *Am. J. Obst.* 1906, 30, 1.

AMPLATZ, P. *Monatsh. u. Arch. f. Gyn. u. Obst.* 1906, 30, 1.

KAJI, S. *Monatsh. u. Arch. f. Gyn. u. Obst.* 1906, 30, 1.

THEILHABER, A. *Monatsh. u. Arch. f. Gyn. u. Obst.* 1906, 30, 1.  
LINDLEY, M. M. *Am. J. Obst.* 1906, 30, 1.

THORN, W. *Monatsh. u. Arch. f. Gyn. u. Obst.* 1906, 30, 1.

THEILHABER, A. *Monatsh. u. Arch. f. Gyn. u. Obst.* 1906, 30, 1.

THEILHABER, A. *Monatsh. u. Arch. f. Gyn. u. Obst.* 1906, 30, 1.

secretion simultaneously in such a way as to  
defy analysis and detection

In this latter class I should also be inclined to place more marked defects such as anencephalic monsters with aplastic cortex of the adrenals<sup>77</sup> and genital defects and feminine pseudohermaphroditism with adrenal hyperplasia,<sup>78</sup> the etiology of neither being determinable because of our present lack of knowledge. Clinically an exact classification cannot always be carried out.

B *Apparently Primary*

Upon careful consideration the experienced gynecologist must realize that he has seen few cases classifiable under this heading which do not show abnormalities pointing to disturbance in other glands of internal secretion. Usually when such are absent the case will prove to be of mechanical origin (tumor substitution inflammatory destruction, etc.) Whether the disturbance is primary in the ovary or secondary to distant trouble does not always become apparent.

a. *Local symptoms* Stripped of all unessential details, there remain referable to the reproductive sphere these symptoms: genital hypoplasia or atrophy, scant irregular or absent menstruation, dysmenorrhea and sterility. No satisfactory explanation for the dysmenorrhea has been obtained. One or all of these cardinal symptoms may be present.

**Nervous type** The accompanying nervous symptoms are too protean to permit of description. In the main they fall under two headings (including both the psychic and general nervous functions): the stable (stolid) and labile (high strung) types. Both are often accompanied by sufficient evidence (small thyroid obesity thick skin or slightly enlarged thyroid tachycardia tremor) to point to thyroid derangement.

c. **Secondary sex characters** Defects or changes in the secondary sex characters occur

frequently. They take the form either of the adult eunuchoid type (hypophyseal?) or show a tendency toward male characteristics (species type of Tandler and Cross<sup>19</sup>) (adrenal or hypophyseal overactivity).

*Th. adult cruxch* is type (T nifier and Grow) shows poorly developed breasts and nipples deficient pubic and axillary hair and scant accumulation of fat in the region of the lower abdomen and about the nates. thin patients or obesity others.

The male type has a dant hair in the axilla, the pectorum a dmons ( th the m le distribution —tri ngle with pex t and the um bilicus) coarse features, deep voice and usually as these patients are thin, lack of f minine fat distribution. Sometimes they erge toward the acromegalic

3. *Ab normalities of the bony skeleton*—long extremities, pelvic nomas (cute pubic arch, high symphysis, projecting sacrum)—point to and the fact that the process has begun before puberty. Persist at an atile proportions are characteristic of true infantilism which may therefore be of congenital origin. (For further detail see Tanner and Graess, [alt.])

**Vasomotor symptoms.** Vasomotor symptoms (sweats flushes dizziness etc) are so distinct from the general nervous phenomena as to be worthy of special mention. They are most marked in the climacterium and post operative (artificial) menopause. According to Schickel<sup>22</sup> they are accompanied by arterial hypertension but further proof must be adduced that this is not merely the physiological sequel of advancing age or premature senility.

*c Other changes* Variations from the normal have been noted in sugar a simulation blood picture coagulation time of the blood blood constituents and response to drugs at present not clearly defined but deserving of further study as possible means of diagnosis.

1 According to Stolper "decreased sugar tolerance (glycosuria after 100 gm. of grape sugar — action probably due to disturbance of pancreas adrenal interrelation)

Myra R. Votham for 1 path and etc. But go on  
to consider the brain order primary. The brain order indicated  
the nucleus considered in one instance deeper, no manner one  
in comparison. In other with well developed brain showed con-  
flict about the nucleus.

ARCADE Res de Gynic 994 2700 (see by the internal)  
 pro lab are female the internal male in type  
 LARRY E. QUART. J. Med 94 These parasiderma, i re-  
 dules regularly have constant

Text 3 auf Seite 9 Die leeren Grundlagen der  
alten Herrscher in der letzten Zeile

[illegible]

fornices, conical cervix short sacro-uterine ligament) : usually not to be differentiated from the permanent sterilities. In this group surprises are frequently met with, pregnancies occurring after years of barrenness without treatment or apparent cause. These patients show a tendency to abort in their first pregnancy about the second or third month.

The permanently sterile may have no variation from the normal type. The great majority, however, are recognized by infan-tilism of the internal genital (side rule) accompanied by other general signs of infantilism (aerual or neuter pelvis—high symphyda, funnel shaped outlet—and often heterosexual hair distribution, small breasts and nipples, etc.). The prognosis in these cases is almost hopeless. These sterilities may be due either to ovarian uterine or combined ovario-uterine deficiency (either congenital or functional in origin).

Anatomically microcystic ovaries are not uncommon in these conditions. Reynolds<sup>14</sup> reports an ovary attending wedge shaped excision (the ovary) the likewise related sterility by causing "permanent corpora lutea at all times (to which as has been drawn by Tandler<sup>15</sup> and which I pointed out in my previous paper, should be considered as possible cause. No other ovarian change have been regularly noted, except those described by Sternmann<sup>16</sup>. I like to present or accidentally through the other ductless glands, the ovaries are at fault because the ovaries (unless completely atrophic) respond quickly to ovarian stimuli by hypertrophy of its muscle and hyperplasia of its mucosa.

Even if ovulation should take place unless corpus luteum formation is physiological the fecundated ovum would probably fail to gain a foothold in the uterus. To test this deduction, I have subjected six sterile patients, all of whom fell into the clinical class of "dysmenorrhea antifection, and sterility but showed few other abnormalities, to a variation of L. Loeb's experiment for the production of maternal deciduum vitæ (which has quite unconsciously been performed for many years by gynecologists).

A long stem pessary as introduced through the cervix will upset the uterine fundus different periods in the menstrual cycle being selected as to

<sup>14</sup>Presumably I feel sure that the ovaries are the main factors. The most common of infan-tilism especially permanent infantilism may be considered as primary infantile sterility through the ovaries.

<sup>15</sup>Tandler's view like the Schneider view and so

case. After seven to ten days had lapsed a curettage (and finally trachelorrhaphy) was performed, and the curettages were examined in serial sections in order to determine whether deciduum had been formed, in response to the mechanical stimulus. All the results were negative.

These results are not conclusive, because on the one hand, Loeb's reaction may be confined to the lower animals (though not solely to rodent as I was able to obtain it in a carnivorous species—the cat) and on the other sterile patients may give no or only a slight reaction.

In the near future I hope to extend this method of investigation (which would prove of value also in ascertaining the time of ovulation) to patients before the performance of hysterectomy (for instance for tubids) because complete examination of the uterus must simplify the histological examination.

## VII. CLINICAL MANIFESTATIONS LOCAL AND GENERAL

The interrelation of the glands of internal secretion, the detailed description of the physiological and pathological genital function of the ovary and such scant data as are available in regard to the anatomical changes in the ovary and uterus were described in detail because without this preliminary intelligent discussion of the clinical manifestations is impossible. But in order to avoid needless repetitions it will prove sufficient in most instances to mention well known symptoms or symptom-complexes without further elaboration and as many of the topics have been dealt with sufficiently in what has preceded detailed description is unnecessary.

The clinical manifestations, just as the anatomical ones, naturally fall into two groups the hyperplastic and the hypoplastic evidenced by phenomena of plus or minus function.

### I. OVITAL REACTIVITY (INFERTILITY)

#### A. Congenital Conditions

Congenital conditions such as true infantilism however must be placed in a class by themselves, as, according to Falta,<sup>17</sup> because the defect which arises, so to speak, *ab ovo*, may be multiple affecting different glands of internal

C *Adult conditions apparently primary*  
These conditions have been discussed under the heading of the *Local Genital Function of the Ovary*. The patients are usually otherwise normal, except in the metritic type in whom an enlarged uterus may be felt. The endometrium from these cases is usually reported by the pathologist as hyperplastic endometrium. Sehr<sup>10</sup> In thirty five cases found the coagulation time decreased, ascribing this change to thyroid inactivity and sustaining his contention by success with thyroid therapy. All these cases must be sharply distinguished from those due to general circulatory disease, pelvic inflammatory trouble, syphilis etc.

D. *Preclimacteric conditions* The same symptom complex occurs about the climacterium. The metritic type predominates. Early cases of carcinoma of the body of the uterus or fibroids<sup>11</sup> may give the same symptoms.

*E Secondary conditions* Quite rarely in the early stages of Graves disease acromegaly and after thyroidectomy for goiter transitory menorrhagias and metrorrhagias occur. This hyperactivity is followed by the more regularly occurring aplasia.

### 3 CONDITIONS OF HYPOFUNCTION OR HYPERFUNCTION IN PREGNANCY

A *Does the Ovary Functionate in Pregnancy?*

No unanimity of opinion as to the functional condition of the ovaries in pregnancy exists. The weight of evidence is about equal. The uterine findings are complicated by the presence of the ovum. We now know that pregnancy can continue undisturbed, and be followed by a normal puerperium after removal of both ovaries at least as early as the sixth week of gestation.<sup>12</sup> As many authors (Halban<sup>13</sup> Starling<sup>14</sup> Shucke<sup>15</sup> Fellner<sup>16</sup> etc.) ascribe distinct secretory

properties to the placenta or foetus or to a combination of both<sup>24</sup> these new factors obscure the issue. The evidence obtained from clinical and experimental reports is contradictory.

A very complete and impartial review of internal secretion as modified by pregnancy is presented by Seitz,<sup>24</sup> who believes that the follicle apparatus is less active ascribing importance to the interstitial gland during pregnancy.

Were the effect of ovariectomy by the possible function of the placenta and lactes the following evidence could point to ovarian hypofunction: decreased sugar assimilation, marked increase in size of the hypophysis (though different from that after castration—chromophobic pregnancy cells), cessation of ovulation. On the other hand, persistence of the corpus luteum, decrease of persistent rhythm, cure or improvement of pregnancy osteomalacia by ovariectomy, favor the theory that the ovary is overactive.

The subject is further complicated by the discovery that at least some of the C cells glands of the fetus probably functionate *in utero*. Carlson<sup>22</sup> has shown that pregnant pancreatectomized bitches are longer Bell<sup>23</sup> that thyroidectomized bitches are less affected when pregnant and Halsted<sup>24</sup> that the young of these animals have enormous thyroids. Werelius,<sup>25</sup> however, concludes that the fetal para thyroids are intact as parathyroidectomized animals die sooner than no pregnant ones (?). Evidently not all the glands functionate.

In view of this uncertainty no attempt to classify conditions in pregnancy into hyperfunctional and hypofunctional can be made.

### B Physiological Variations

The changes in the general organs will be found in Hofbauer's article "Erdheim and Stummé" describe the anatomical alterations of the hypophysis. Bone changes (osteophytes Rokitanaky) \* pelvic joint changes, Loeschke<sup>(42)</sup> increase in height in youthful pregnant women, coarsening of the

Even the decision has had an internal security effect according to (see Lantini interview.) Am V. Am is (in 1974)

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<sup>100</sup> Holbaum: Die Gerinnungsveränderungen der Organe in akuter Nephritis. Verhandl. d. 1. Internat. Nephrolog. Kongress, Basel 1916, S. 210.

<sup>10</sup> KADWIN J and STUNEL, E. Zanger. Best 1999 str.

<sup>20</sup> Kozlovskiy Lehrbuch der pathologischen Anatomie 1864

<sup>20</sup> Lohschütz, II Arch. f. Geol. 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, 1900, 1901, 1902, 1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934, 1935, 1936, 1937, 1938, 1939, 1940, 1941, 1942, 1943, 1944, 1945, 1946, 1947, 1948, 1949, 1950, 1951, 1952, 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 

Singer E. Maschinen und Menschen 1964, S. 285

It will be known that the prisoners in above are large and contain numerous bacteria, bris, Mischers and W. Schuler, or (1911) believe that increased or altered excretion in urine causes the above growth and hence any of the various bacterial agents, effect on the blood.

LARK (LAWTON) J P and STARLING F H Pres Key Sec

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

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Fig. 1 Interstitial gland, low power. Above the fold border cavity of an atretic follicle is shown; its lower margin forms the interstitial gland. T.C. follicle cavity.

include the main facts known concerning the changes in pregnancy.

### VIII DIAGNOSIS

The complex mechanism, which produces the various functional disturbances discussed in this paper, can never be solved by the routine gynecological examinations as now practiced. In order to attain progress much clinical research is necessary. The outline here given contains suggestions, which will vary in each case and which will undoubtedly require modification as new facts are elicited. In a modern hospital the cooperation of the various staffs (gynecological, obstetrical, roentgenological, pathological, chemical, etc.) can be enlisted to make the task of each individual less arduous.

#### A. Local examination including—

a. Internal genitals. Size and position of uterus, relation of cervix to fundus, shape of vagina and fornices; examination of curettings (with regard to menstrual phase); study of removed ovaries and uteri.

b. External genitals. Development especially of clitoris.

c. Type of pelvis. Infantile, feminine, neuter measurements.



Fig. 2 Interstitial gland, high power. A portion of follicle with higher magnification.

#### B. General examination including—

a. Secondary sex characters. Hair distribution (mons, perineum, axillae, face, etc.); fat distribution (especially on nates, lower abdomen, suprascapular fossae, supraorbital); larynx and voice; dimensions (length, relation of extremities to trunk); breasts (size, shape, fat or gland, nipples).

b. Size of thyroid (also pulse rate, tremor, eye symptoms); acetonitrile test of Reid Hunt.

c. Enlargement of lymph nodes; thymus; persistence if ascertainable.

d. X-ray of sella turcica if acromegalic or eunuchoid symptoms are found; also of epiphyses of long bones when dimensional anomalies are encountered. In appropriate

<sup>100</sup> HUNT, REID. J. Am. M. Ass. 1907, 3:48. Mice fed with 1 cc. of blood from 1 case of acromegalic patient prepared 1 cc. on much acetonitrile (C.H.A.) to kill them 10-15 days later. No mice fed on normal blood (0.04—0.06 mg. acetonitrile/litre).



*Retropetio* Only one case has been reported that of Ribes already very ancient. It is plain that in a region in which anastomosis is so frequent the only thing to do is extirpation.

*In the forearm and hand* Very rare. Monod and Vanverts collected 5 cases, all of which were treated and cured by extirpation. It may affect any of the vessels of the forearm. They have all been of traumatic origin. In Bazi's case the interosseous vessels were affected.

*At the bend of the elbow* Common in the times of venesection, not very frequent since. Le Dentu and Delbet collected 66 cases. In 1889 Monod and Vanvert have collected 8 cases since. These cases almost always occurred between the humeral artery and the median basilic vein.

*In the humeral artery* Rare. Eight cases were found in 1889. In 1909 two more cases were found.

*In the subclavian artery and its branches* Pleyette and Broman collected 19 cases, 9 were caused by piercing instruments, 8 by bullet, 2 by fracture of the clavicle, all in the third portion of the artery. No spontaneous cases were reported. These cases must be treated early, otherwise they are fatal on account of profuse hemorrhage and hæmatomata.

*In the common carotid artery and the internal jugular vein* Le Dentu and Delbet collected 19 cases in 1889. Monod and Vanverts have collected 11 cases since. All were of traumatic origin except one by Querrel which was spontaneous.

*In the external carotid artery* Rare. Le Dentu and Delbet found only 3 cases in 1889. Two of these were treated but without success.

*In the internal carotid artery* Extremely rare. Only one case on record, operated three years after accident by Keen, followed by recovery. The prognosis however is bad.

*In the head and face* Le Dentu and Delbet found 11 cases affecting the superficial temporal, one the occipital, and two the facial artery.

Monod and Vanverts collected 4 cases, two of the temporal, one of the occipital,

and one of the internal maxillary artery. In the line of treatment double ligation with extirpation has given the best result.

In consideration of the foregoing the author feels called upon to report a unique case of aneurysm of the deep epigastric artery and vein occurring in his service at the St. Mary of Nazareth Hospital, Chicago.

**CASE REPORT.** Mrs. J. S. of Staceyville, Ill., aged 43, housewife German. Family history unimportant. Personal history negative until married full term deliveries three times, six miscarriages involuntary. At a well up to the birth of the first child at 23 the child weighed 13 1/2 pounds and delivery was instrumental. She has been suffering with pain in the back and legs, and has never felt strong since this labor. She subject to constipation. Eczema (on dermatitis) four years ago. Present illness dates back about eight years, when he was delivered of twins in the eighth month of gestation, both of twins being dead and bearing evidence of having been dead for some time. Puerperal infection followed and the patient was in bed for weeks. A aneurysmal condition of both legs developed at this time. The deep veins are involved there were no veins visible but several aneurysms were palpated below the knee and about the ankle on the right leg. There was a much milder displacement of the same condition on the left leg. The legs responded promptly to proper treatment but would usually recur when patient was up and attending to her daily duties. One year later the patient was operated for laceration of the cervix. In following this operation the patient has been suffering pains in the right hip region these pains were more pronounced on pressure. While talking patient would often try to support this region with her hand. When rising patient would kneel on chair with right knee. Patient found it easier to carry things with the left hand although she was not left handed. She was neurasthenic, depressed, listless and not interested in events socially or otherwise that would engage the attention of her family. She was a victim of insomnia for eight years. At times awakened at night all stiff and bathed in sweat. At such times she had violent palpitation of the heart and a menacing vertigo. During these eight years the patient had been examined by number of doctors of prominence and by some of international reputation. All reported negative findings, the great disappointment of the patient and her family. All stigmatized her as an hysterical, claiming her ailments were imaginary. And all this time the patient suffered the symptoms described as boy to say nothing of her mental state upon being told time and again that she was bothered with imagination. The patient consulted the writer August 9, 1900 and in addition to the bo history the examination revealed a moderately glycosuria specific gravity

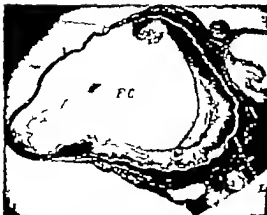


Fig. 3. Cross section of ovary, corpus luteum in stage of involution. F.C. follicle cavity, L. luteal cells. Slightly retouched to show distribution and width of luteal layer.

cases the ocular fundi, the field of vision (slight color) reaction of nerves to electricity must be tested.

#### C. Blood examination

a. Full blood count (number of leucocytes, proportion of neutrophils, lympho-

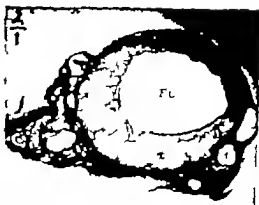


Fig. 4. Cross section of ovary, corpus luteum in stage of rupture. One of several large atretic follicles. Shows thick crested luteal layer. F.C. follicle cavity, L. luteal cells.

cytes, and eosinophiles are most important [Dirks<sup>13</sup>].

b. Coagulation time (by Wright's method or some modification [A. Keller<sup>14</sup>]).

c. Blood pressure.

d. In appropriate cases investigations of the amount of glycogen, lipids (fat, cholesterol, and cholesterol esters).

<sup>13</sup>Dirks, M. Arch. Gynec. 55, 200 (1935).

<sup>14</sup>Keller, A. Arch. Intern. Med. 19, 301, 309.



Fig. 5. Recently ruptured follicle. This is one of the preceding microphotographs in section from the left. The follicle cavity (F.C.) is empty. The margin of the granulosa (G) or epithelial lining is feathery. The cells retain their appearance and distribution as in the unruptured follicle. The theca interna cells (T.I.) are relatively large and numerous. The theca externa (T.E.) is smaller.



Fig. 6. Corpus luteum early prohemorrhagic stage. The follicle cavity (F.C.) contains coagulated serum. The granulosa cells have increased in number. The theca interna cells are prominent.

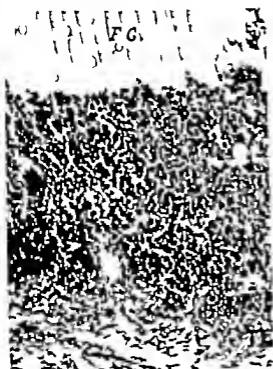


Fig 7 Corpus luteum later stage of procleration. The granulosa cells (G.L.) have multiplied. They still show distribution as in the follicle and contain no lutein.

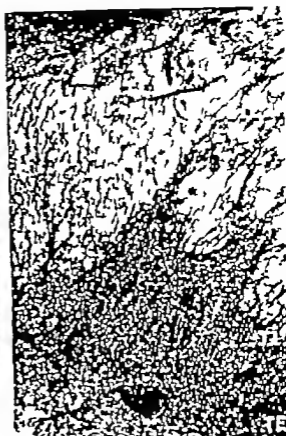


Fig 8 Corpus luteum early vascularization. The follicle cavity contains red blood cells. The granulosa cells have become lutein cells (L). Numerous fine irregularly distributed blood vessels have penetrated between the lutein cells. The lutein cells are unusually numerous in this specimen.

D Sugar tolerance (increase decrease amount of dextrose necessary to produce glycosuria [Stolper & R. Keller<sup>14</sup>])

E Reaction to drugs especially to

a Adrenalin (local mydriatic general glycosuric)

b Pilocarpin (weakly diminished in hypofunction increased in hyperfunction)

c Atropin

F If the services of a physiological chemical laboratory can be enlisted metabolism examinations in cases of special interest. These would include —

a The respiratory coefficient (ratio of  $O_2$  intake to  $CO_2$  excretion)

b Analysis of the food intake (fat, protein carbohydrate  $P_2O_5$  S Ca Mg etc)

c Simultaneously similar analysis of the urinary and fecal excretion and of the intermediate products of metabolism

The numerous current reports based solely

upon the urinary excretion are of no value as in many diseases deficient or increased excretion through the kidneys is compensated by an increase or decrease of excretion through the bowel. A careful record of even a limited number of cases observed with regard to the factors just indicated would prove of far greater value than large numbers of incomplete reports in which one or more isolated phenomena are studied. The value of such clinical research which is urgently needed would be further enhanced by extending the observations to three periods—before during and after treatment.

<sup>14</sup> Ketter. *Medicine and Chemistry* 1914, 13, 40.



Fig. 9. Corpus luteum, end of vascularization. The follicle cavity has been invaded by spindle cells which begin to slough off the central clot from the theca layer. The radial distribution of the blood vessels is complete. The theca interna cells form a narrow marginal layer. The theca externa (T.E.) is increasingly eosinophilic.



Fig. 10. Corpus luteum. Stage of regression (early). The central clot is well sloughed off. The crusted margins are defined. The radial vessels are numerous.

## IX. TREATMENT

With the exception of the application of the X-ray a few pioneer attempts to transplant and to resect portions of the ovary and corpora lutea, and the tentative use of some new organ extracts (anterior lobe of the hypophysis, pituitrin, adrenalin) few changes can be recorded in the last three years.

1. *Organotherapy* In the main this method of treatment has proved disappointing. Thyroid extract is the only substance which has shown the full physiological effect of the gland (probably because the active principles are stored in the gland — *Vorresdrüss* — instead of passing into the circulation almost as rapidly as formed).

a. *Ovariotherapy* Various forms of the extract of the entire ovary and of the corpus

luteum have been tried. My own views have undergone but little modification since 1910.<sup>20</sup> Favorable reports continue to appear in the literature concerning the oral administration of ovarian, oophorin, ovario-lecithin, yolkémbin, lutelin, etc. and subcutaneous use of ovarin (Poehl) lutelin, etc. The chief effect noted appears to be relief of the vasomotor symptoms. Recently Adler<sup>21</sup> has reported that after administration of ovarin by mouth, in two cases of amenorrhoea, he was able to demonstrate premenstrual and menstrual changes in the uterine mucosa. A similar result in castrates would prove more convincing.

Recent experimental reports dealing with the use of *fluid extracts of the ovary and placenta* appear to show a specific stimulating effect on the uterus (Iacovescu,<sup>22</sup> Feller,<sup>23</sup> Adler,<sup>24</sup> Hermann<sup>25</sup>). The most complete report, that of Feller indicates that these extracts are extremely toxic. Schickel<sup>26</sup>

<sup>20</sup> FRANK R. T. *Lancet* (London Med. Journ.) vi, 32.

<sup>21</sup> IACOVESCU H. *Compt. rend. du Acad. de Sc. de Paris*.

<sup>22</sup> FELLER O. O. *Arch. Gynék.* 1921, 461.

<sup>23</sup> ADLER S. *Arch. Gynék.* 1921, 524.

<sup>24</sup> HERMANN H. *Zentralbl. f. Gynék.* 1921, 370.

<sup>25</sup> SCHICKEL E. *Zentralbl. f. Gynék.* 1921, 370.



Fig. Corpus luteum. Stage of expansion (lat). The characteristics mentioned under Fig. 1 are accentuated particularly the swelling of the central spot ( ). Theca interna cells are noted only in the septa.

has used ovarian extract (without corpus luteum) prepared by subjecting the tissue to high pressure.

Buchner press. This phase of the question is still in its infancy.

From the foregoing reports it appears justifiable when so disposed to exhibit ovarian extracts in hypofunctional conditions of the genitals. The administration by mouth is harmless subcutaneous introduction requires caution.

b. *Thyroid extracts* Even the physiologically active extract has given variable results. Personally I have obtained fair results in amenorrhoea complicated by obesity if the genital atrophy was not extreme and the thyroid gland appeared diminished in size. In some cases in whom five grains twice daily did not produce tachycardia

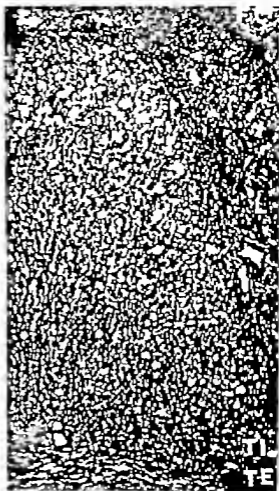


Fig. Corpus luteum, stage of regression. The follicle cavity contains firm connective tissue replacing the clot. Theca interna cells are irregular in size. Also theca interna cells are noted.

menstruation was reestablished in from four to eight weeks. The obesity did not diminish. Striking results were obtained with small doses (one gr. twice daily) in the early months of pregnancy for the relief of nausea and vomiting.<sup>128</sup> Unless the symptoms improve within two to three days and no tachycardia is noted the treatment regularly fails.

Sehrt has just reported the successful use of iodothyron in functional menorrhagia. He warns that oozes is met with only in cases in which the coagulation time of the blood is decreased, and that

<sup>128</sup> See also A. Zerkow, *Gynaek.* 1940, 223, 237, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.



Fig. 1. Section of the adrenal gland showing the cortex (F.C.) and medulla (M.). The cortex is divided into three layers: the outermost layer is the zona glomerulosa, the middle layer is the zona fasciculata, and the innermost layer is the zona reticularis.

throughout the course of the time in the adrenal gland. It must be recalled that the adrenal gland is not only a source of epinephrine but also a source of androgen. The adrenal gland is also a source of androgen. The adrenal gland is also a source of androgen.

c. Adrenalin does not contain the entire physiological properties of the adrenal gland. Recently a lipid-soluble extract has been isolated from the cortex. Adrenalin has been employed with success for osteomalacia (side effect) by Hays and other. Pituitary extracts, anterior lobe extract, have been recommended for the adipose type of genital atrophy (Cushing). Pituitary extract of the posterior lobe is a valuable mainly a stimulant of contraction in labor.

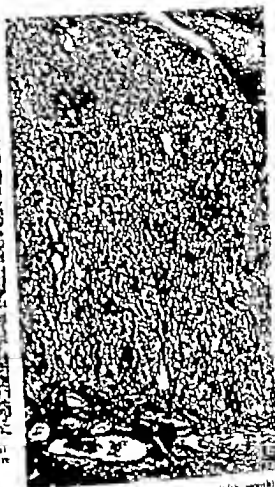


Fig. 2. Section of the adrenal gland showing the medulla (M.) and cortex (F.C.). The medulla is divided into two layers: the outermost layer is the zona glomerulosa, and the innermost layer is the zona reticularis.

It is now too well known to require mention. In two cases in one of which the crisis was completely dilated, alarming tetanus was developed after the use of but one unit of anterior pituitary extract. The pituitary effect on the uterus must be regarded as purely local and in the nature of a simple drug action (stimulation of the nervous plexus).

Adrenalin and pituitary extracts are marketed. As yet no trustworthy reports of their effect on the genital have appeared.

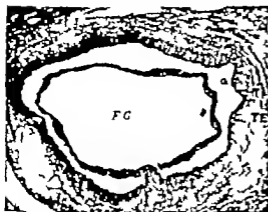


FIG. 5. Transverse section cross an atretic follicle. During involution the epithelial (granulosa) (b) layer has shrunk. (a) from the theca interna this plant shows their relative thickness.

1. *Combined organotherapy* is advocated especially by French authors. The subject is too obscure to permit of intelligent discussion at the present time.

2. *X-ray treatment of hyperfunctional troubles.* Persistent menorrhagia and metrorrhagia without anatomical basis respond well to the roentgen ray. This method of therapy is a great boon in the functional hemorrhages of puberty. It has cured extreme cases in which local treatment (repeated curettage) calcium lactate by mouth or rectum or serum injections had failed and in which hysterectomy had been advised as a last resort. I have used it with success in adults, and at the time of the climax (invariably excluding malignant disease of the uterine cavity by curettage before beginning the treatment). At puberty considerable doses given at intervals in order to allow an occasional menstruation to occur are necessary. When the menses become scant and infrequent the treatment may be stopped and the patient kept under observation. In patients from 30 to 35 years of age who do not desire to lose their menses permanently the exposures should be continued until slight climacteric molimina or amenorrhoea develop. Menstruation usually approaching the normal reappears in four to eight months. These patients should be watched for relapses. Older patients readily become per-

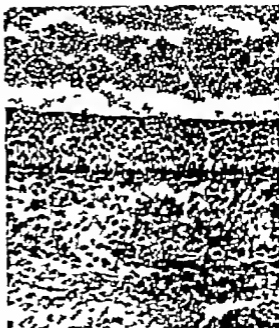


FIG. 6. Wall of atretic follicle. The follicle cavity contains detritus. The margin of the granulosa layer is smooth. The theca interna is wider than the epithelial layer.

manently amenorrhoeic. I am as yet unable to state whether more careful dosage and earlier stopping of the exposures can prevent the annoying climacteric symptoms which occasionally develop. Whether the roentgen ray produces permanent injury to the ovary and exerts a deleterious effect on pregnancy (foetus) years after the treatment has been stopped is not yet determined. This possibility should be kept in mind.

In a few cases of subacute chronic and inflammatory disease of the adnexa in which operation was either refused or contra-indicated and in which profuse and repeated hemorrhages occurred the X-ray was of use. In these cases rapid effects must be obtained as the preliminary stage of excitation (and increased bleeding) is pronounced.

The suggestion to utilize this preliminary stage of ovarian stimulation, in cases of hypofunction does not appeal to me because it is impossible to graduate the dosage with sufficient accuracy to avoid increasing the ovarian deficiency.



Fig. 7. More advanced stenosis. The follicle cavity has been almost completely obliterated by fibrous connective tissue. The bougie epithelium has disappeared. ( ) The characteristic hyaline band, external to which are theca interna cells.

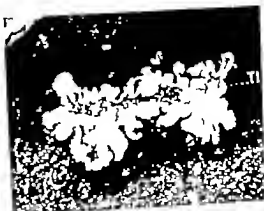


Fig. 8. Advanced stenosis. The follicle cavity is completely obliterated. The hyaline band has shrunk and, therefore, assumes bizarre contours. The theca interna cells are resuming their spindle form and the outline of the follicle is no longer definable from the ovarian stroma.

3. *Resection of the ovary* (Microcystic (Dysmenorrhoea, Sterility). Henkel<sup>12</sup> reported relief of dysmenorrhoea and anomalous menstrual bleeding after resection of the ovaries. Reynolds,<sup>14</sup> who suggests that the change is often secondary to mild tubal infections, likewise reports a high percentage of cures.

In the present stage of uncertainty it appears unjustifiable to perform a laparotomy without some stricter indication than dysmenorrhoea or sterility. When encountered incidentally during an abdominal operation wedge shaped resection may be performed.

4. *Transplantation of the ovary*. Numerous reports of primarily successful homotransplantations and heterotransplantations (Martin<sup>15</sup>) are on record. The consensus of opinion is that the operation does not give permanent results. The implanted ovaries eventually become absorbed, after the follicle apparatus has undergone cystic degeneration and destruction. To avoid the necessity of extensive secondary operations, in such cases in which disturbing symptoms arise from the transplants, it is advisable to place the grafts in well vascularized but accessible regions (the rectus abdominis).

5. *Local uterine treatment*. With the advance in our knowledge the uselessness of

indiscriminate curettage has become apparent. In sterility it is of no value. In hyperplastic menorrhagias (fungoid endometrium) occasionally permanent, more often only transitory relief is obtained. In this type, however, curettage retains its importance as a diagnostic agent (to differentiate from neoplastic processes).

The stem pessary used in infantile genitalia may produce an accentuation of the decidual reaction (*vide ante*). At present it is employed empirically. The various plastic operations on the cervix devised for sterility and dysmenorrhoea act mechanically (drainage etc.) and therefore do not enter into this discussion.

The nasal treatment of dysmenorrhoea<sup>16</sup> probably causes improvement through the nervous system. Recent research by Koblenck and Roder<sup>17</sup> showed hypoplasia of the genitals developing in animals, after resection of the turbinates.

6. *General systemic treatment*. As our means of affecting the genital organs by specific drugs are still unsatisfactory general measures have not lost their value as therapeutic agents. If employed near adolescence general hygienic measures (exercise, fresh air, proper clothing, diet, hydrotherapy, tonics, etc.) may assist either in curing, or at least arresting, the advance of hypofunctional

<sup>12</sup> HENKEL. *München. med. Wochenschr.* 1901, 1902, 1917.

<sup>14</sup> REYNOLDS. *F. II. Surg. Gynec. & Obst.*, 1904, 7, 2.

<sup>16</sup> REUTEMANN J. *Surg. Gynec. & Obst.* 1901, 1902, 1903, 1904.  
<sup>17</sup> KOBLENCK and RÖDER. *II. Zeit. klin. & chirurg.* 1903, 1904, 1905.

troubles such as amenorrhoea, dysmenorrhoea, and sterility. In the true obesities (as distinguished from "Istodfettsucht") restriction of diet is of minor value. Improvement in general health, at all periods of life helps to ameliorate the many concomitant nervous phenomena, which so frequently form the chief complaints of gynecological patients.

7 *Drug treatment.* For the sake of completeness drug treatment must be mentioned. It is of little value. In dysmenorrhoea Drenkhan<sup>12</sup> has recommended atropine (in injections into the cervical tissues locally applied by means of tampons or by mouth). Adler<sup>13</sup> believes that it acts only on vagotonic individuals. For the pain narcotics are frequently necessary. The use of drugs which are supposed to stimulate the pelvic organs such as aloes, johimbin, etc. is illusory. Functional menorrhagias and metrorrhagias fail to respond to ergot, hydrastis, styptol, etc.

### GENERAL SUMMARY

In this paper the attempt has been made to emphasize the following facts:

1 That the glands of internal secretion control and regulate many vital processes, including development, growth, nervous impulses, psychical manifestation, metabolism and reproduction.

2 That each gland, regarded individually exerts a predominant influence upon one or more of these functions.

3 That in order to produce a perfect individual and maintain perfect health the interaction of these glands must be normal.

4 That disturbance of this perfect interaction reacts upon the genital sphere in only one of two ways—in an increase or a decrease of function.

5 That the gonads, in turn may react on one or more of the other ductless glands, causing a multitude of variations.

6 That the ovary through which all impulses to the genital tract are transmitted or in which they originate, is a compound

organ (like the hypophysis or adrenal) made up of at least two (follicle apparatus, corpus luteum) or perhaps three (interstitial gland) components.

7 That of these components, the follicle apparatus (and perhaps the interstitial gland) controls the growth and nutrition of the genitals, the corpus luteum controlling the periodicity and production of the cyclical changes.

8 That the local pregnancy changes are probably accounted for by the persistence of the corpus luteum, but that the products of conception which surely cause the persistence of the yellow body may share in causing both the local and systemic phenomena accompanying pregnancy.

9 That genital hypofunction manifests itself clinically chiefly as follows:

a Anatomically, locally by aplasia of the genitals, systemically by the signs of infantilism, eunuchoidism, and other variations depending upon the time of onset and the other ductless glands most affected.

b Symptomatically by scant or infrequent menstruation, amenorrhoea, dysmenorrhoea, and sterility.

10 The genital hyperfunction manifests itself clinically chiefly as follows:

a Anatomically, locally no change, metritic type, fibroids (?) systemically often no change.

b Symptomatically by too profuse, too prolonged or too frequent menstruation occasionally by overfertility.

11 That our present methods of diagnosis require extension and refinement.

12 That organotherapy is unsatisfactory. A ray treatment valuable in default of better resection and transplantation of the ovary purely tentative, local treatment nearly powerless, and general hygienic measures still our mainstay.

13 Finally that further progress will depend upon intensive study of anatomical material in connection with elaborated functional diagnosis and symptomatology instead of upon haphazard empiric therapy.

## VOLVULUS TORSION OF THE WHOLE MESENTERY

## REPORT OF CASE WITH RESUMÉ OF THE LITERATURE

B. RALPH E. WHELE, M.D. FARGO, NORTH DAKOTA

**CASE HISTORY:** In 1897, a 27-year-old, well-built man weighing 50 pounds said that he has had some kind of abdominal trouble as long as he can remember. He recalls that as a small boy he had sharp attacks of colic. He has been bled 11 times and has been constipated all his life. With the aid of laxatives his bowels have moved three or four times a week. At eighteen he stopped taking physic since which after three days of constipation, towards morning he would have a sharp pain in the right lumbar region extending as high as the 11th rib. This would last half an hour and would be followed by a bowel movement. This cycle of symptoms would again recur three days later. He further states that a heavy meal would be followed by an epigastric distress spreading around the right side of the belly.

Previous to his recent illness he drove traction engine for a week. There was a constant jarring from this and he soon reported the machine was perfect to one. He rested in right knee upon the foul box and turned the wheel of his body on the other leg. The following Monday he drove a wagon to work. Towards evening he was driven home. Wednesday morning at 10 A.M. he was awakened by a severe pain in which extended across the abdomen. At 1 P.M. morphia was given. Pulse and temperature were normal, and he passed gas. To-day and Thursday night his condition was worse. The colicky pain radiating down across the abdomen was continuous and showed no localization. He vomited many times and had diarrhea which he ascribed to physic that had been given him. By Friday the diarrhea had ceased and an emesis gave no result. Four or five times he passed a dark liquid. The pain remained the same but hyperemic of morphia at noon gave some relief. Accompanied by his physician he came to the hospital that evening.

Examination showed a man who looked well, who complained of pain over the whole abdomen. There was moderate tympanites and tenderness to pressure everywhere. No peristaltic waves could be seen though perhaps this was due to morphia administered before taking the train. There was no local enlargement or pulsation. A short time was no local sign of any kind. Intestinal muscular rigidity was evenly distributed. Temperature 100° pulse 84, respiration 20.

The onset pain and vomiting suggested a shock. The early passage of gas and the loose bowel movements of the previous day seemed to suggest it. Though a diagnosis was impossible, an anastomosing condition was plainly present. Operation was immediately performed.

**Operation:** May 23, 1903. An incision was made at the outer edge of the right rectus, and was doubled in length on noting the condition of the presenting coil. All of the small intestine was badly distended, was dark red in color and turned to blue on manipulation. Serum was present in only moderate amount. A careful search for the cecum failed, but proved it was absent from the right side. Examination of the root of the mesentery cleared up the mystery—the whole mesentery was twisted so tightly that it felt like a lead rope. The torsion was a little more than 180° in the direction of the hands of the clock. When the whole of the small intestine was eviscerated, the cecum was pulled into view from the left lumbar region. There was a common ileocecal mesentery. The mesentery at point on the ileum few centimeters from its attachment (too short and exerted so much traction as to obstruct the bowel). Proximally the ileum was badly distended, the few centimeters distal and the ascending colon were only moderately distended. (Later on your attention will again call to these mesenteric folds.) The twisting was reversed and the intestines returned within the abdomen. With the slightest exertion gas freely passed from the badly distended small intestine into the cecum. A small drainage tube was placed in the peritoneum and the wound closed.

The patient was returned to bed in good position, placed in the Fowler position, and sedative by the Murphy method begun. Recovery as usual. There was no post-operative vomiting and gas passed the following noon by eructing thus accompanied by colored water, and the next evening.

Noble's omea was followed by a bowel movement which gave great relief. He left the hospital on the nineteenth day and has remained well.

A careful review of the literature showed but two successful cases in America that of Shepherd in Canada, reported in 1898, and George Tully Vaughan a case in our own country reported in 1907. This is sufficient reason for discussing the subject.

To determine and select the cause has been a matter of great difficulty since the main facts are given but by few and many of the reports are so incomplete that the extent of the volvulus cannot be determined. What ever else is omitted, the phrase torsion of the whole mesentery should appear with

every report. Most attempts at collecting have been made within the bounds of certain languages. Fantino states that but 14 cases, including the unsuccessful ones, had been reported up to 1906. Lerda, quoted in Burghard's System of Surgery, says that up to 1908 only five cases, including his own, had been successfully operated upon. The following list of recoveries seems to be genuine and proves that these statements are too conservative.

893	Bron, M. J. W. R. (probable)
898	Shepherd, F. J. (quoted by Vaughan)
90	Williams, M. J. C. L. (probable)
904	Whiting
905	Philippowicz, two cases
905	Mohring (quoted by Daneshoon)
907	Hutchinson, Jonathan
1907	Ball, P.
907	Tenson, René
1907	Schultze
1907	Vaughan, Geo. Tully
1908	Lerda, G.
1909	Costa (quoted by Fantino)
909	Blecher
1909	Brunswick Le Bihan
909	Billington
1910	Wille, two cases
91	Fantino
911	Newton, H. A. S.
91	Bosquette
Twenty two cases	

A further compilation of 45 cases, some successful, some post mortem findings, has been secured and has been consulted whenever there is a variety of opinion among the observers.

Most often the age is given as "after middle age" or "among the old." Where it could be ascertained it was found to be—

Up to 10 years	cases
Up to 20 years	cases
Up to 30 years	1 case
Up to 40 years	4 cases
Up to 50 years	8 cases
Up to 60 years	cases
After 60 years	8 cases

Moreover it has often occurred within the first ten days of infant life—the volvulus of the new born. It can be seen then, that it occurs at all ages, but with the fewest cases between 30 and 40.

The male sex is peculiarly disposed. In 64 cases, 13 were women and 51 men. No reason for this selection has been advanced.

As to the direction of the twist, by far the majority indicated it by the phrase "from left to right" or "to the left." This is capable of misinterpretation. To carry conviction is to say "in the direction with the hands of the clock" or *rotatoria*. Philippowicz, who has had a remarkable experience with volvulus of varying extent, found it in the direction opposite to the hands of the clock in but 2 out of 24 cases. In my list it was opposite to the hands in 7 out of 37 cases.

The anatomy is very interesting. The root of the normal mesentery is about six inches broad, extending obliquely from the left side of the second lumbar vertebra to the right sacro-iliac symphysis and contains within it the blood vessels and nerves from the beginning of the jejunum to the caecum. In these cases it is not so broad and may be more horizontal, and frequently it is longer than usual from the spinous attachment to the gut margin.

In the third fetal month the duodenum has a mesentery and the third portion is not the closely attached organ that it later becomes. The colon too has not become fixed by a blending of its peritoneal coats to the posterior wall, and the mesentery of the small bowel is continuous with that of the caecum. P. Michalewicz says that this condition persists into the fourth fetal month. All of the cases in the new born show this embryonic condition, and where it was looked for most authors remark it present in the adult. For this reason it is a common thing then, to find a part of the large intestine in the volvulus—the caecum and even as much as the greater part of the transverse colon. In such cases the caecum is found near the spleen, or a little lower.

In 1902 Burgess reported the case of an 8 year-old boy who died without operation. His autopsy report is so typical of these cases that it is well to include it. He says: "The small intestine, caecum, and colon possessed a common mesentery which, while of considerable depth as measured from its spinal to its enteric attachment, was of very limited vertical extent. The root of the common

mesentery did not reach below the third lumbar vertebra and was directed much more horizontally than normal leaving the right iliac fossa quite free from any mesenteric attachment.

The literature abounds with references to adhesions, peritoneal folds, mesenteric folds, or contracted bands fastened to the bowel or obstructing it. Much confusion has occurred from their presence which at times has led to tragic results. Encountering such a condition Delbet made an anastomosis and only at autopsy found the volvulus with the anastomosis uniting the jejunum and the terminal ileum. What are these folds or bands? No doubt many are true adhesions and should be severed. Philipowicz says that he nearly always found evidences of previous mesenteric lisa, so that the mesentery is thickened and shortened at times. But these folds can be formed entirely by the volvulus, as illustrated by the case here given. It is possible that they are produced in the following manner. A loop of bowel is fixed perhaps by adhesions, or the terminal ileum is anchored by the larger colon or the mesentery at this point is actually shorter than the rest, then, with the winding up of the mesentery as on a windlass, strong traction is exerted upon the fixed portion. The practical point is that in the presence of obstructing mesenteric folds, nothing should be attempted until after examination of the root of the mesentery.

Another point not clearly understood is the amount of torsion required to produce obstruction. It is usually put at  $\frac{1}{3}$  or  $\frac{2}{3}$  of a circle. Von Manteuffel's case was only 90 and yet was fatal and Delbet says that in one of his cases it was but little more than  $\frac{1}{4}$  of a circle. If a 90° torsion of the mesentery is pulled tight, there is obstruction to the blood vessels. If a mesenteric fold to the cecum is pulled taut or the colon compressed by the mesentery of a loop of small gut drawn tight across it there is obstruction to the fecal current therefore it is probable that the tightness of the twist and the obstruction of the intestinal contents are the important factors rather than the degree of the torsion. The usual extent is 180° but two cases of even 720° have been reported.

**Etiology.** The primary predisposing cause is a developmental anomaly the most important being a shortening of the mesenteric root in the vertical diameter. A long mesentery with a cecum mobile would greatly increase the tendency.

Other predisposing causes as given by the different observers are

- 1 Old scar formation and chronic mesenteritis (Philipowicz, Kettner, Robinson)
- 2 Former operations (Waring, Ruedel, Häberer, Schultz, Robinson, Shepherd)
- 3 Hernia (Rokutansky, Vaughan)
- 4 Fibrous bands (Terson)
- 5 Mesenteric cysts (Häberer, Ferris)
- 6 Habitual constipation and chronic intestinal stasis with traction on mesentery (Bouquette, Delbet)

Among the exciting causes given are

- 1 Violent peristalsis from heavy cathartics, overeating, excess of fermentation (Wille, Fantino)
- 2 Heavy lifting (Von Manteuffel, Fantino)
- 3 Blow on abdomen (Fantino)

From the foregoing one concludes that given a small sized mesenteric root and a common ileocecal mesentery a torsion can occur from exaggerated peristalsis. A hindrance to peristalsis at certain points as from a stasis or overfilling or adhesions, would increase the violence of the muscular action of the bowel proximal to it. Bodily strain or trauma would further the possibility.

**Symptoms.** There are numerous cases that, like the one here presented, give a long history of habitual constipation or attacks of pain, perhaps with vomiting (Brubaker, Schreiber, Krohn, Falun, Philipowicz, Lerda, Blocher). This has occurred often enough to make it of some importance. Frequently without previous trouble the patient is taken with sudden excruciating pain which is either referred to the umbilical region or is not easy to locate (In one of Lerda's cases it was not severe and was located in the sacro-iliac region radiating into the sides).

Vomiting is almost invariably present. It may be bilious, but later it is a dark colored watery material. It is seldom if ever fecal since the bowel is incapable of emptying itself in either direction (Vaughan's case had bloody vomiting as soon as the volvulus was corrected).

Constipation is, or soon becomes complete. It is accompanied by more or less tympanites and frequently areas of exaggerated peristalsis are seen. High enemata can often be passed but return giving no relief. Rigidity is unusual.

Temperature is either afebrile or but little above normal frequently it is subnormal. The pulse is but little changed until collapse threatens, when it becomes weak and fast. Many cases have gone to operation with pulses from 80 to 100. In Fantino's five cases the pulse was 90, 110, 90, 80, and 100 respectively with but one recovery in the series.

Collapse and death may come as early as 16 hours (Burgess) or as late as two weeks. Thus great variation depends principally on the completeness of the obstruction of the blood supply. The facial expression in the early hours is merely that of suffering later the abdominal fascia is present.

**Diagnosis.** While Delbet believes that the absence of fecal vomiting is characteristic, many observers mention its presence and Fantino is careful to note it in two of his cases. The following are the important signs:

1. Great pain most often centering in the umbilical region.
2. Obstruction and meteorism.
3. Vomiting, usually not fecal.
4. Slight change in pulse and temperature in the earlier hours.

There is nothing here that will differentiate it from obstruction, and most writers agree that the diagnosis is impossible. Once the abdomen is opened palpation of the root of the mesentery tells it all.

**Prognosis.** Absolutely bad without operation. If the obstruction has lasted long enough for the vessels to become thrombosed the patient will likely die anyway. In my collection of 65 cases there were 23 recoveries.

**Treatment.** Early median incision, evulsion, and detorsion. If the intestine will not permit of manipulation first puncture empty and suture. In favorable cases a plastic operation to prevent recurrence (Philpotts) might be thought of.

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3 and slight albuminuria. After month treatment the urine was normal.

September 28, 1900 the patient was admitted to St. Mary of Nazareth Hospital, Chicago, was given treatment for trochanteric ulcers and, after these were healed, preliminary course was instituted preparing her for operation. She was very corpulent and had large and pendulous abdomen.

October 4, 1900 patient was operated by the writer. A right rectus incision was made. After the usual dissection, cutting through 6 inches of fat, a varicose aneurism of the deep epigastric artery and vein (figs 7, 8 and 9) appeared. The sac between the two vessels was the size of goose egg, the vessels below were dilated to about three fourths inch diameter and below to about one half inch. The entire mass was about seven inches long. Double ligatures were applied to the vessels above and below and the mass was ruptured. There were ramifications of vessels in almost every direction. As after the removal of this mass, number of minor vessels had to be ligated before the hemorrhage was controlled. Following this the peritoneum, the right ovary and tube and meso of ovaries were examined. The right broad ligament was excised. The peritonitis was inflamed and fat matly adherent to the right ovary and tube. There were inflammatory bands almost completely encircling the caput cervicis. The incisions were closed by sutures in the usual manner but drain was placed in the abdominal wall to take care of fat necrosis. The patient made an uneventful recovery and has been in excellent health ever since. Now little over three years. Patient says she never felt so well before, takes interest in everything, attends social and other functions common to former wife and now she enjoys life.

This case is interesting and instructive on account of the uncommon location of the varicose aneurism, the symptoms that baffled some of the best observers, the successful outcome of the operation, its occurrence in a woman and without a history of trauma, other than that pertaining to instrumental delivery while in labor. It is the only case of the kind on record as a thorough search of the literature has failed to reveal a single parallel case.

**Possible causes.** Trauma incidental to pressure on the abdomen during instrumental delivery followed by puerperal infection. Dilated vessel walls through which infected blood may have extravasated forming an infective clot, and then ulcerated into the vein. An infected embolus or thrombus ulcerating through the original vessel into another.

**Medical problems.** Is the theory tenable that an infected blood clot *per se* either within the vessels (emboli or thrombi) or outside the vessels in the perivascular tissues (extravasation from the thrombi, etc.) by ulcerating into one or more blood vessels, may form an arteriovenous aneurism? Might the increased blood pressure incidental to labor plus the trauma of instrumental delivery cause this condition?

What is there to offer in the prophylaxis of arteriovenous aneurism?

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Fig. Dark portions, epithelium. C. T. connective tissue.



Fig. Connective tissue showing decrease in cells.

barrier against the further advance of the epithelium is created until the battle for existence generally terminates with a victory for the connective-tissue cells. The erection of new defensive walls and the advance of additional forces for the protection of the connective tissue territory becomes more difficult for the organism in proportion to the local anemia and the imperfect blood vessel dilatation due to atheroma; to say nothing of impaired circulation, deficient cellular metabolism and decreasing activity of the heart. All these factors appear in organic old age, in scars and in chronically inflamed tissues, but are particularly significant when several of them are combined. It follows then, that if the connective tissue cells succumb in this battle the barrier against unlimited epithelial proliferation is removed. Still other factors contribute to the development or origin of cancer. A deterioration of the tissue fluids, a "humoral disposition to cancer" is present in the majority of cases.

All my investigations convince me that the connective tissue cells, leucocytes, and lymphocytes antagonize epithelial cells. It is necessary therefore to study the variation in structure and the functions of the blood-forming organs in their relation to the disposition to cancer. I began my investigations in the central *abattoir* of Munich where the best opportunity was offered to study

the internal organs of healthy animals of different ages. I soon convinced myself of the fact that the disposition to cancer is in inverse ratio to the development of the blood-forming organs in the different age periods. The variability in the development of Peyer's patches in the intestine is of especial interest. While they are very prominent and immediately noticeable in young animals, they are so highly atrophic in the old that they must be looked for. The spleen not changed by disease undergoes a marked atrophy with advancing age; the trabeculae project on the cut surface, the follicles grow smaller and poorer in nuclei. The lymph-glands also become smaller with advancing age; the lymphocytes become sparse within the meshes of the reticulum; the parenchyma is in many places replaced by adipose tissue. Atrophic conditions are also found in the bone marrow with advancing age. The marrow is red and lymphoidal in youth, later changing to a fatty marrow, poor in cells, and it appears as a colloidal marrow in old age; i. e. a gelatinous change of the fatty marrow with a somewhat darker yellow color. The activity of bone-marrow is somewhat lessened in advanced age and an atrophic condition of the whole blood often occurs. These facts for the most part already known to the anatomist have not been emphasized in connection with the origin of cancer. Therefore I can

## CAUSAL FACTORS IN THE DISPOSITION TO CANCER IN OLD AGE

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A LARGE series of portions of skin and mucous membranes in individuals of different age were compared in order to ascertain why old people are so frequently attacked by cancer. Many variations were observed some of which were already known from the study of anatomy but which have not so far been mentioned in connection with the origin of cancer. Thus, connective tissue shows characteristic differences at various ages. In the fetus it has a remarkably large number of cells, the intercellular substance being very scanty. In the infant the percentage of cells in the connective tissue gradually decreases, while the intercellular substance increases. With advance of age, the number of connective tissue cells decreases (Figs. 1 and 2).

Atrophy of the cells and a diminution in their proliferative power occur together with a decrease in their number and, *vice versa*, an enlargement of the cells and cell nuclei and an increased proliferative power take place with an increase in number. Epithelium, on the other hand does not usually show any marked retrogressive metamorphosis.

Based on our opinion on these observations, we may state that the intensity of a disposition to cancer is in inverse ratio to the number of cells found in the connective tissue.

A second difference is found in the behavior of the blood-vessels. The supply of the healthy tissue with blood is the more abundant the younger the individuals. Exceptions at times are caused by the more or less intense activity of the blood-forming organs. The walls of the blood-vessels, as a rule, are thin in young individuals, the lumina relatively wide. The opposite holds good in old people: the vessel-walls becoming thickened, the lumina smaller. Here also the conclusion may be drawn that the disposition to cancer is in inverse ratio to the blood supply of the tissues.

If organs which have been invaded by cancer are examined we usually find in the

connective tissue about the growth very few cells, blood-vessels stenosed and with thickened walls, and signs of endarteritis obliterans (Figs. 3, 4, and 5). An exception to this is noted, however, in that the tissues immediately surrounding the outermost proliferations of the cancer show a more or less marked reactive hyperemia with cell infiltration, usually of slight extent.

I drew the conclusion from these and many other similar observations that the local disposition of aging tissue to carcinoma, results from a diminution of the cellular elements and a contraction of the blood vessels in the connective tissue.

However these changes alone do not suffice to excite an unlimited proliferation of epithelium. Other disturbances are usually present in those regions of the body subject to malignant invasion. Thus, scars and chronic inflammations, above all, belong to the precancerous state. Very few cells and a limited number of usually constricted blood vessels, are also found in old cicatrices and in tissues which have suffered for a long time from chronic inflammations (Fig. 7).

I explain the process of development of cancerous degeneration as follows. Epithelium does not transgress its borders under normal conditions, because the connective tissue cells protect themselves by defensive bodies against any such invasion. Epithelial proliferation, however is facilitated if the fixed cells, lymphocytes, and other elements making up connective tissue are scarce and atrophic, especially if this cellular atrophy has become highly marked at a given place on account of cicatricial changes or long-continued inflammatory processes. Then if senile atrophy also becomes associated with such conditions the epithelial cells have an easier little for existence. They penetrate into the connective tissue, whereupon a round-celled infiltration appears, together with an increase of the protective measures against epithelium. Thereby an additional



Fig. 5 Nulliparous uterus with carcinoma. Each about the carcinoma. B. V. blood vessels.



Fig. 6 Carcinoma of uterine body. Blood vessels in the surrounding tissue.

tissue and the lymphatic glands as far away from the growth as possible. They have endeavored to operate in the most radical manner. The result of this has been an increased mortality ratio after cancer operations, and the reduction in frequency of recurrence is on the other hand but slight.

I claim that a considerable reduction in recurrence can never be attained by a more and more extensive extirpation of the surrounding tissues of the cancer. The removal of the local and humoral disposition of the patient is the cure of the cancer disease proper. It seems to be more successful. If one would extirpate the toe on account of a frequently recurring gouty swelling, a cure would only exceptionally result from a change of metabolism caused by the operation or from any other cause. The gouty swelling would sooner or later appear at another place in the body, perhaps in the region of the scar. If we expect the cure, we must attempt to change the entire body fluids by diet, abundant bodily exercise, bath, etc.

The conditions are similar in many cases of anemias. Here, too, the condition of the blood must be improved just as well as the local power of resistance toward pathogenic proliferation must be increased. To attain the latter I attempt to produce an increased proliferation of connective tissue cells and a marked infiltration of the structure with leucocytes and lymphocytes by nutritional improvement of the blood. This can be ob-

tained by definite methods of hyperæmia, which may be performed by various means such as Bier's hyperæmic treatment, massage, etc. The diathermic method as introduced by Nagelschmidt and Zeynek has proved the most efficient. It also produces a marked hyperæmia in places which are far removed from the point of application of the electrodes.

If an organ is treated for a long time with diathermy, the vessels dilate and the tissues hypertrophy according to my observations. This dilatation of the vessels and hypertrophy of the tissues lasts many months. Besides these, an increased accumulation of round cells in the connective tissue is found after frequent use of diathermy, and the connective tissue cells proliferate markedly. Conditions arise therefore exactly the reverse from those in the beginning of cancer. We see correspondingly good results in the after-treatment following cancer operations. The scars remain red, become rich in blood vessel round cells and connective tissue cells. I use diathermy periodically during each year two or three times, in eight to ten sittings of fifteen minutes each. At the same time I give subcutaneous injections of certain organic preparations (spleen, uterus, thymus) near the scar. A marked venous hyperæmia is thereby caused in the immediate surroundings of the scar which lasts for a number of days. Besides the marked dilatation of the blood vessels, a considerable round celled in-

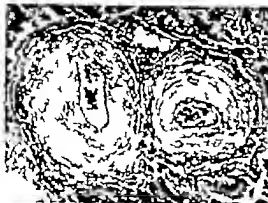


Fig. 3. Blood vessels in the neighborhood of carcinoma in the wall of the uterus.



Fig. 4. Malignant cells in the wall of the uterus, with blood vessels.

clude that the younger the individual and the better the development and function of the blood-forming organs, so much less is the inclination to cancer.

A cancer can, as a rule, originate only in people in whom local and humoral disposition is present. The local disposition consists according to the above statements, in a decrease in the number of connective-tissue cells and in their blood supply, the results of an atheromatosis of the blood vessels. The humoral disposition to cancer is largely due to an atrophy of the blood-forming organs which occurs in different individuals in varying degrees of severity.

#### THE PREVENTION OF POST-OPERATIVE RECURRENCE

After removal of a cancerous tumor with the knife or by radiotherapy, a new growth forms in the majority of cases in a relatively short time. In more than three-fourths of the cases it arises in the region where the primary cancer was located. Many physicians assume that by far the most of these recurrences arise from small cancer parasites which were left behind. It is certain that this is a frequent cause of recurrence, but I believe that cases are not very rare in which carcinoma recurs as a result of still other causes. In my opinion they arise not only from a continued existence of a local predisposition, but the operation may even increase this local tendency to the growth of

cancer since the operation scar consists of tissue quite similar to the atrophic structures from which the cancer tends to originate. As it is a settled fact that every extensive scar predisposes to cancer we cannot see why a scar caused by operation should be an exception to the rule. It becomes poor in connective-tissue cells and blood vessels when it grows older and the continued existence of the humoral disposition has a marked influence upon the development of recurrences.

The observation that there may be recurrences in places distant to the operating field aside from any preexisting metastases is best explained by the humoral disposition. As such recurrence is favored by traumatism and similar influences, the origin can be explained in the simplest manner by accepting a cancer disease in which the tumor arose at the place of least resistance. Thus, for instance, V. Ilmann observed after a breast amputation a recurrence on the parietal bone as the result of a fall on the head. E. Vix reports a recurrence on the vertex after an operation for cancer of the abdominal wall in a laborer who carried loads on his head. After an amputation of the thigh for sarcoma, Cohn-Stein saw a recurrence not in the scar but in the gluteal region which was exposed to a continuous pressure.

Proceeding on the theory that the majority of recurrences are caused by leaving behind cancer-germs, surgeons have attempted to remove all cancer cells by exchanging the cellular



Fig. 8 Shows hyperemia and hypertrophy of the scar of patient who was operated on six years ago and treated frequently with diathermy and venesection. The suture canals lying close to the axilla are not covered by the broad electrode during the diathermization. They are very pale and readily distinguishable by their color from the medium red suture canals covered by the electrode. The hypertrophy of the tractors is also absent in the peripheral suture canals. Note that intervals of four and six months exist between the day the photographs are taken and the last treatment by diathermy.



Fig. 9 Shows the opposite view the condition of the scar of patient not treated hereafter. The scar is so pale that it is recognized with difficulty. It is highly atrophic like all old scars.

pale but red as during the first months after operation. They frequently show a keloid like hyperplasia of the tissues remain movable on their substructures, and do not contract to any extent. It is very improbable that such changes in the histologic structure of tissues threatened most with recurrences should not favorably influence the prevention of a recurrence.

My results are as follows. Of seventy two cases of cancer coming for treatment during the last five years I operated radically upon thirty seven. Twenty four of these submitted to a long continued hyperemic treatment. Twenty of these are at present still free of any recurrence, three died during the first year following the operation from metastases of the internal organs, a fourth contracted a local recurrence to which she succumbed. Of the twenty well patients, six were operated upon five years ago, and five four years ago. Christoph Müller (Immenstadt) has treated during the last four years a series of twenty cases of mammary cancer in a similar manner without a single recurrence. Seven of these

patients were operated upon more than four years ago. They all were at the limit of operability. Altogether eighteen cases treated four years ago and six treated five years ago are free from recurrence.

The method of my after treatment of cancer patients following operations ought to be one of the most important advances which has been made for some time in the field of cancer treatment, judging from all I have seen during observations covering five years. An especial advantage of this method is that the family physician can cooperate in the work of preventing recurrence. Bier's hyperemic treatment and the injection of organic extracts can be given by any physician.

A discussion of the value of this after treatment following cancer operations by X-ray finally remains. It is intended either to destroy tumor remnants left behind or to prevent the development of a new cancer or to heal developing recurrences. In the first



Fig 7 E epithelioma C T connective tissue

filtration was seen on microscopic examination at the injected places in rabbits. These injections have the advantage that they favorably influence the humoral disposition. According to my investigations, the changes in the body fluids which permit cancer formation are largely brought about by defective function on the part of the blood-forming organs. The injection of certain organic preparations, particularly of the thymus the spleen, and the uterus increases the activity of the blood-forming organs, resulting in a marked leucocytosis which renders the formation of epithelial proliferation difficult. Diathermy may also be used to increase the function of the hematopoietic organs. Therefore, I treat the spleen several times yearly in a number of sittings with the diathermy apparatus. This is followed by a marked increase in the number of leucocytes in the blood. A sojourn in high altitudes, the avoidance of alcoholic beverages, the use of vegetarian diet, salt and mud baths, and active and passive exercise have proved of benefit.

The genital glands (ovaries and testicles) act apparently favorably on the development of cancer, their influence being cancerigenous while the blood-forming organs possess cancerlytic action. Therefore I attempt to produce an atrophy of the sexual glands by roentgen treatment in women who are still

menstruating. Recurrences after breast amputation is more readily prevented if the ovaries are destroyed. The clinical experience which different operators had had with castration in inoperable carcinoma coinciding with this fact. Whether it would be rational to castrate men under these same conditions would have to be demonstrated by clinical experiments.

I perform venesection in all patients from whom cancer has been extirpated, removing 300 to 400 ccm of blood twice yearly. This markedly stimulates the activity of the blood-forming organs. I often successfully resort to venesection in people 70 to 80 years old. Flachera reported at the Cancer Congress held in 1913 at Brussels that he could confirm the beneficial action of venesection proposed by me as a prophylaxis against cancer recurrence, basing his allegation on experimental investigations. If he bled mice, the resistance against inoculation with cancer grew due to the increased activity of the hematopoietic organs.

I begin the hyperemization during the third month following the operation, that is, at a time when the scar begins to atrophy.

The described after-treatment has still another very agreeable side effect: the subjective well-being soon improves during treatment.

The patients often complain of abdominal pains, backaches, discharges, etc. after extirpation of abdominal cancers. These symptoms are caused by the scars and by the disturbances in the circulation of the blood due to the scar formation. All such annoyances improve considerably after the induction of hyperemia. After operations on the breast, pains in the scars and limitation of motion of the arms often persist. An essential improvement tends to take place after hyperemic treatment, which might advantageously be combined with massage.

The influence of hyperemic treatment can also be demonstrated objectively. It may best be seen in those scars which are easily exposed to inspection, for instance in those after breast amputations. The scars are entirely different from those obtained under ordinary conditions. They are not

# DEPARTMENT OF TECHNIQUE

## A NEW AND RAPID METHOD FOR OPERATING UPON IMPASSABLE URETHRAL STRICTURE

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THIS technique has already been reported but continued experience in its use has strengthened its claims in my estimation as a reliable method in certain cases. All operators come in contact with a varying percentage of cases of impassable stricture by which is meant impassable to any instrument in the hands of the particular operator, whether or not the flow of some urine may be possible. This percentage is to a certain degree a personal equation and therefore the adoption of this technique is also more or less governed by the same factor. Personally I have never been compelled to perform suprapubic cystotomy for retrograde approach to the urethra owing to an unsuccessful attempt to find the urethra by way of the perineum. But I must own to having been in some very critical situations involving the expenditure of a laborious length of time in attempting external urethrotomy without a guide for impassable stricture. And in certain cases this difficulty has been as much in finding the distal or anterior section of the urethra as in locating the proximal or posterior end. For the latter the method suggested by Young, of reaching the apex of the prostate, may be used most effectively. It is of course, from this point in my hands, an easy matter to find the course of the urethra anteriorly in cases where the stricture area is exceedingly tortuous and buried in nodular tissue. The intermediate portion may be resected, and the finding of the distal or anterior portion materially facilitated by injecting an aniline fluid through the ureters, to stain the urethral tract to the site of the perineal wound. But this attempt is not always successful when pocket and false passage exist.

The technique in question was originated by the chief of my staff, Dr. D. A. Sinclair, the application of whom has usually employed. The result is a complete mastery of the difficulties of an otherwise troublesome complication.

It is desirable that the patient retain urine for several hours previous to operation. This is

obviously unnecessary in cases of complete retention. The operation is performed under local or general anesthesia, as preferred. A cannula and trochar about 16 French caliber is thrust just over the pubis in the median line into the bladder with the latter under distention either with urine or antiseptic fluid forced through the urethra. When the trochar is removed, the fluid is emptied and the bladder is cleaned as before a cystoscopy. Now, through the cannula is introduced an indirect lense telescope of proper caliber to fit the tube. Through this the internal orifice of the bladder is viewed with absolute clearness. The distal aperture of the cannula is then applied to the internal orifice the telescope removed, and a curved, flexible obturator is introduced through the cannula, which readily enters the prostatic urethra, and may be advanced as far as the apex of the prostate, or even the membranous canal. A finger introduced into the rectum determines the success of the procedure.

The flexible obturator is provided with fine tenor lumen through which a filiform or whalebone bougie may be introduced which often finds the proximal opening of the stricture and then may be advanced until it appears at the meatus. In such instances the remaining steps of the operation are much simplified. A perineal cut is made on the point of the obturator the bougie guide is drawn through the perineal opening and a small rethrotome knife with an eyelet is fed thereupon toward the anterior section, and the strictured area is incised. In cases where it is not found possible to advance the bougie to the anterior urethra the method of injecting an aniline blue solution is adopted but through the canal of the obturator while it is applied directly to the point of obstruction. In either of these instances the performance of the operation is simplified and, as compared with the older method of suprapubic retrograde urethrotomy or perineal section without guide its duration is surprisingly short.

case the X rays will have to be used immediately following the operation in the second and third instances it will be necessary to use the rays intermittently for years at definitely timed intervals. Remnants of tissue may be destroyed by the discutaneous method if primary union is desirable. Success will be obtained in only a very small number of cases. The probability of success is greater when the rays are applied through an open wound. In such cases where we do not suture on account of a plastic operation to be undertaken at a later date or for other reasons, it is advisable to leave the wound open for a longer or shorter time and to expose it intensively to the X-ray. However Werner who often used this procedure reports that it does not positively protect against recurrence. Concerning frequent prophylactic intermittent X-ray therapy to bring about the immediate destruction of beginning recurrences, I do not believe that any great number of successful results can be obtained thereby. I refer to the communications of Hennecke whose investigations were corroborated by Krause, Aubertin, and others. He showed that the blood-forming organs are very much endangered by intensive use of X-rays. The cells of the bone marrow, spleen, and lymphatic tissues react markedly to roentgen and radium rays producing a degeneration of the nuclei. The number of the lymphocytes and leucocytes decreases to subnormal, after a transient polynuclear leucocytosis, to recuperate only slowly. The blood cells cannot be protected by a filter technique as they are attacked especially by the harder gamma rays passing

through the metal filter which we need for applying X-rays. The blood-forming organs undoubtedly recuperate from the disturbances caused by the rays. However if the rays must be used again and again, recuperation ultimately ceases.

Considering the great importance a perfect function on the part of the blood-forming organs possesses as a prophylaxis against cancer it is not probable that by means of the sole use of radiotherapy the percentage of recurrences is markedly decreased. If one wished to destroy with a probable certainty beginning recurrences before they become macroscopically recognizable then the X-ray must be used several times a month for many years. Experience in roentgen-cancer has shown that the disposition to cancer is directly increased by the too frequent use of the rays. If the rays are used very diligently after operations, the cancer disease is frequently aggravated and a recurrence is probably directly excited. If the rays are not used very frequently then it must be a coincidence if one does but a recurrence which is not yet macroscopically recognizable and thus prevent its growth.

The communications so far reported about the frequency of recurrences after X-ray treatment seem to verify the correctness of this evidence especially for the non-gynecologic cancer. Heydenham reported at the tenth congress of the German Roentgen Society at Worms in 1914, that the prophylactic use of X-rays has not markedly decreased cases of recurrence. Similar reports were made at the meeting of Natural Scientists and Physicians in Vienna in 1913.

## TARSALGIA

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MUSCLE weakness and the loss of muscle tone are the fundamental causes of most of acquired foot troubles. Depression in power and tone as a result of constitutional conditions such as infection or intoxication or both, prolonged fatigue and nerve exhaustion and faulty nutrition and metabolism when combined with severe trauma in a short period, or long continued slight trauma will inevitably produce static disorders.

Normal muscle stress which is necessary to maintain the upright posture in weight bearing becomes an abnormal muscle stress or muscle strain when the muscle for any reason has been depressed in power or tone. Normal muscle stress frequently gives rise to tenderness and pain in muscles owing to a toxic irritation of the muscle-cells. Weakness of isolated muscles or groups of muscles is frequently encountered and one must determine whether or not there exists isolated trophic disturbances or some peculiar developmental condition. In considering the perversion of function of normal structures, one must reckon back from the pathological conditions which he has in hand through the various steps in the mechanism which has produced it to the normal for the individual under inspection.

Abnormal pose of the body as a whole or any portion of it as well as abnormal muscle balance must be determined and compared with the normal for that individual if one would draw his conclusions correctly. If a muscle or group of muscles working parallel to another muscle or group of muscles, for any reason is not performing its normal function the correlative muscle or group of muscles is subjected to inordinate or abnormal stress and since normal stress under abnormal conditions becomes strain the muscles so imposed upon suffer injury.

Muscles which are forced to act between their abnormally approximated attachments

shortened to accommodate function to the altered working distance. Normal muscles which are subjected to constant abnormal strain lose resiliency and become flaccid, or develop conditions of rigidity or spasm.

The tendons of the long flexors of the toes as they pass around the os calcis add a considerable force in opposing pronation. If either of the tibials or both are depressed in power or tone the long flexors of the toes are involuntarily stimulated to over action, and naturally their opposing muscles are forced into abnormal contraction the violent action thus instituted progresses until either nerve inhibition releases the muscles from their excessive burden or a certain degree of spasm results—a condition of flexor and extensor spasm frequently manifested by sharp flexion of the toes. If the anterior tibial is depressed in power or tone then the posterior tibial has an extra burden put upon it, and the long flexors are called upon to assist in maintaining the normal position of the foot in weight bearing. Under these conditions of strain the muscle irritation will be manifested by tenderness and pain in the muscles or pain referred along the tendons to their insertion or both, and to the structures adjacent to the muscle attachments. If the derangement of muscle balance begins within the organism from pathological conditions or is initiated by some external condition, as false pose of the body or vicious position of the feet under strain the result is a perversion of function. When the anterior tibial is depressed in power or tone, the posterior tibial is stimulated to greater action to compensate for the loss of power. Under continued overstimulation this muscle is depressed and becomes relaxed, or it may develop spasm even of a comparatively violent nature. Under this condition of spasm the stress exerted upon the os calcis by virtue of the relationship of the posterior

# THE STUDY OF CHRONIC INTESTINAL STASIS BY MEANS OF THE RÖNTGEN RAYS

By GEORGE E. PFALLER, M. D. PHILADELPHIA

SO much excellent work has already been done upon the subject of intestinal stasis by such men as Lane Jordan, Bainbridge, Quimby Leake, and many others, that it would seem hardly necessary to write more. The importance of the subject, however, and the lack of thorough appreciation by the general profession, will probably justify my effort.

The symptoms which result from chronic intestinal stasis have been previously summarized by Bainbridge as follows: (1) Headache, severe and frequent (2) nausea, followed by retching or vomiting (3) anorexia, almost constantly present (4) loss of weight (5) coldness of extremities (6) mental apathy (7) constipation (8) foul taste in mouth, often accompanied by foul breath, canorous teeth, and furred tongue (9) abdominal distention, relieved by eructation, the passage of flatus, or an action of the bowels (10) abdominal tenderness over the areas of fixation (11) skin-staining (12) breast changes, simulating chronic mastitis, in the early stages, and cystic degeneration in the later stages (13) general muscular pain and more or less marked stiffness of joints.

The diagnosis of chronic intestinal stasis can be suspected from the clinical symptoms, but the definite cause and location of the stasis can be determined only by means of the roentgen rays, or by a rather extensive exploratory operation.

In the consideration of this subject, stasis caused by obstruction due to malignant disease will not be considered.

## TECHNIQUE

In the study of intestinal stasis, I believe that it is best not to disturb the usual routine in the life of the patient more than is absolutely necessary. Therefore at the beginning of this study the patient should not be purged, should not be starved, and should not be interfered with in the quantity, quality or time of the usual meals, for by so doing one creates more or less artificial conditions, which may lead us to overlook stasis, or to observe mechanical conditions which may have no real influence upon the symptoms of the patient.

Laxatives. If the patient has been accustomed to laxatives daily it is probably well to allow this to continue up to within twenty-four hours of the

beginning of the examination. In extreme cases it may be well even to continue it during the study for by so doing one may often recognize how ineffectual the customary laxative is, and why.

In the early case, or where the patient has moderate symptoms, it is usually well to omit all laxatives during the examination, and for twenty-four hours previous. Patient should be allowed to eat his usual breakfast. One hour later he should be given, as recommended by Jordan, a glass of water containing four ounces of bicarbonate of soda, and a half ounce or more of sugar of milk. (Jordan recommends one and one-half ounces, but this amount seems to have caused diarrhea in several patients that I have examined.)

By manipulation of the stomach the bowels can be made to act thoroughly with the partly digested food. The stomach can then be clearly outlined and a fair idea obtained of its position, size and motility. Even gross defects can be detected by this process. Spasmodic contractions, when present, may also be recognized. I believe this is not the best mixture for the study of gastric ulcer and carcinoma, or for duodenal ulcer.

The patient is examined first fluoroscopically in the erect posture, and as many roentgenograms are made as seems necessary in each particular case. The patient is then placed upon the fluoroscopic table and examined fluoroscopically in the supine position. He is then turned in the right lateral, which permits complete filling of the duodenum. The patient is then quickly turned on his back, and the duodenum is either examined fluoroscopically or a roentgenogram is made and this process may be repeated until satisfactory evidence is obtained of the conditions present. One may find dilatation and stasis either in the first, second, or third portion of the duodenum. By this means one recognizes the extent of the obstruction caused by mesenteric attachment, the duodenojejunal junction, as described by Jordan.

If the stomach seems to be emptying well with abnormal rapidity a second examination should be made at the end of three hours. If it

The diagnosis of duodenal carcinoma must not be based on the present day concepts of Roentgen Ray Roent, and there is no reason to think it is. J. Am. Med. Ass. Feb. 11, 1911.



Fig. 1. Shows retention in the ileum, at only four hours after barium meal diet kink.

is emptying at normal rate or is delayed a second examination should be made at the end of six or more hours. At the six-hour examination normally the food should be in the terminal coil of the ileum, and in the cecum and ascending colon. A third examination may seem advisable at the end of from nine to twelve hours, at which time normally the head of the barium column should have reached the splenic flexure or probably in small fragments, even the rectum. Another examination should be made at the end of twenty-four hours at which time normally the barium mixture should have been passed or should be found in the rectum sigmoid and transverse colon.

Stasis may at times be recognized in the coils of the small intestine, such as occurs at times in extensive adhesions following an old peritonitis. Generally however, the first evidence of stasis is recognized in the terminal coils of the ileum. If below, one cannot look upon retention in the terminal ileum as evidence of stasis unless it is present at the end of one or two hours. Stasis in the terminal portion of the ileum may be due to a kink, which has been described by Lane or to adhesions which are generally secondary to chronic appendicitis or may be due to either organic or spasmotic constriction of the ileum. Lane has seen cases of paralytic constriction of the ileocecal junction causing retention in the terminal coil of the ileum for more than twenty-four hours. The presence of the Lane kink in this region can be determined by examining the patient in both the erect and recumbent postures, which procedure by the difference in the position will cause retention in the out-



Fig. 2. Shows stasis in the cecum and ascending colon. The cecum mobile.

line of the coils of the terminal portion. If it is due to adhesions, one will find difficulty in separating the various coils of the ileum or in moving them about at will. One may at the same time be able to recognize other evidence of adhesions, such as fixation of the appendix, immobility of the cecum, or fixation of the cecum in certain directions. Cecum mobile is recognized by this same procedure. Retention in the ileum may also be due to a patulous ileocecal valve which permits reverse peristalsis to cause backward pressure in the ileum.

Stasis in the cecum and ascending colon is recognized by the retention of the barium mixture in this portion of the bowel for from twenty-four hours to many days. It may be due to a kink which has formed at the hepatic flexure or it may be due to mass adhesions secondary to gall bladder disease or secondary to a perforating gastric or duodenal ulcer which has observed, or it may be due to a Jackson membrane which in some cases seems to interfere with the peristaltic action. If it is due simply to a kink one may differentiate it by injection of the colon in the supine posture in which event the colon will fill freely or can be made to fill freely by light manipulation. The lumen of the colon can be known to be complete whereupon if the patient assumes the erect posture the kink reforms and can be demonstrated. If the distention is due to mass adhesions one may be able to find that the transverse colon cannot be separated from the



Fig. 3. Shows stasis in the cecum and ascending colon and in the first portion of the transverse colon.



Fig. 5. Shows stasis in the transverse colon forty-eight hours after obstruction at the splenic flexure.



Fig. 4. Same case as No. 3. Shows obstruction in same region of the colon, myelogram both due to Jackson membrane.

ascending colon or there may be reduplication in the first portion of the transverse colon which cannot be straightened out or the entire hepatic flexure may be fixed securely. Then, too, one may be able to demonstrate the presence of the primary cause of such adhesions, such as gastric, duodenal, or gall bladder disease.

Stasis in the ascending and transverse colon may be due to stenosis at the splenic flexure. This stenosis may be caused by a kink or may be due to a mass of adhesion which sometimes causes a constriction in both the terminal portion of the transverse colon and the first part of the descending colon. In such instances gas is produced at the splenic flexure. Such patient complain of a great deal of distress in the left hypochondriac region,ague pain and flatulence; the patient tries to eruct gas from the stomach, which of course gives no relief since the gas is not in the stomach, but seems to go the secretion of gas in the stomach. If these cases the diagnosis is rarely made and often is not even suspected until a roentgen examination has been made.

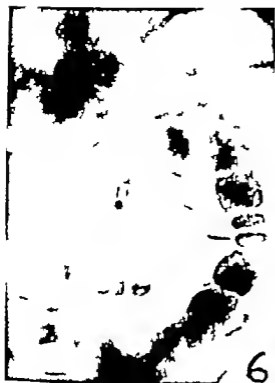


Fig. 6. Same case as Fig. 5. Shows obstruction at bicusplenic flexure through chronic intussusception. You will notice the great accumulation of gas under the left side of the diaphragm. The colon could not pass through the first constriction and this gas chamber became bigger and bigger until it gradually ruptured the descending colon.

*Obstruction at the splenic flexure and stasis.* The reverse of the same may also be used by spiking loops. These loops consist of longations of the colon in the region of the splenic flexure which permit accumulation of gas and twisting of the colon thus temporarily block the progress of the colonic contents. In many cases the descending colon will remain filled for a long length of time because the splenic flexure in this section of the colon is very tight and when there is no obstruction to the normal flow of the colon contents it is not felt but the contents carried back into the transverse and ascending colon. Therefore the transverse and ascending colon may be distended with gas and the descending colon may be distended with feces and obstruction at the sigmoid flexure exist.

The effect of this may be just as painful as the one from time to time because it has experienced the intense desire for stool at a new interval time and then this new interval disappears. The disappearance



Fig. 7. Shows obstruction in the descending colon due to a kink. This patient developed recurring attacks of colic obstruction covering a period of one week in four years. Organic lesion was found at operation. Notice the abrupt termination of the colic at operation. The hemorrhoids in this patient is in the sigmoid colon.

of the distended to the reverse peristalsis which carries the contents back into the ascending and transverse colon.

*Obstruction of the flow of the colon contents through the descending colon.* may be due to spastic adhesion, neoplasm, kink, or twist. The presence of adhesion is recognized after justifying the colon, by fixation of a portion of the bowel. Spasms are recognized by the clear cut line separating the bismuth content of the bowel from much the pyloric phenter separates the content of the stomach from those of the duodenum normally. In fact, I have observed these spasmic constriction in the descending colon more often than in any other portion. I believe that these spasmic constrictions are reflex but I do not yet know the cause.

Neoplasm is difficult to separate from the normal portion of the bowel either by pressure from without or by growth within the lumen.

Kinks can be recognized because they develop only in certain positions and when the position is



Fig. 8. Shows sigmoid loop which rises to the level of the diaphragm and causes periodic attacks of intestinal obstruction, which were usually interpreted as such head aches.



Fig. 9. Shows retention after the bowels are supposed to be thoroughly empty, and also shows accumulation and retention in the descending colon and the rectum, due to the pressure of the rectum. This patient complained for twenty years of constant desire to go to stool, probably due to the pressure of the rectum upon the rectum.

varied sufficiently during the examination, these kinks can be released.

Obstruction of the sigmoid is more likely to be due to kinks, adhesions, neoplasms, or twists, occurring in connection with a redundant sigmoid.

Kinks may cause definite localized obstruction to the ascending beneath column, but one cannot conclude that such kinks, or obstructions, are absent simply by following beneath meal from the mouth, because of the reverse peristalsis which may cause this portion of the bowel to be completely empty at the time of examination. I believe that these kinks more often result from a redundant sigmoid, which produces the sigmoid loops, the tops of which may at times reach the diaphragm, and when this loop becomes distended with gas, it may not only cause a kink at the sigmoid flexure, but may cause pressure upon the transverse colon and upon the stomach, causing temporary obstruction at these two or three places. In other instances the sigmoid loop may extend across to the right side of the abdomen. Such a loop may be present for a long time without giving rise to symptoms, but if the abdomen

relates from some acute illness, from pregnancy or from emaciation, the bowel is permitted to dilate and then evidence of obstruction and stasis, with exaggeration of all other symptoms, follows. I believe that these loops are not a normal condition, but that they may be present in healthy people. I have never found them however in anyone not suffering from some abdominal or toxic symptoms.

The sigmoid is also a favorite location for neoplasms. Adhesive bands following inflammatory conditions within the pelvis are also frequent. When adhesive bands are the cause of the symptoms, one has difficulty in separating, and moving freely, the sigmoid and upper portion of the rectum.

Stasis within the rectum may be due to spasm of the anal sphincter, to actual organic obstruction, or more commonly to a torpor or loss of sensation of desire for stool. I commonly find the rectum greatly distended with fecal matter, and yet the patient has no desire for stool and not the slightest sensation of the presence of this fecal matter in the rectum. I believe that this loss of the sense of rectal pressure is much more

common than we know, and that it results from carelessness, or modesty early in life at which two nature's call is ignored, and is ignored so long and so often that finally the nerves do not respond to this stimulus and I believe that commonly this is the primary condition causing intestinal stasis. The colonic contents are then dammed back, causing a stretching or elongation of the sigmoid producing finally these large sigmoid loops, with the secondary links and definite obstruction in other instances causing elongation of the descending colon and producing loops in the splenic region — for I am quite sure that the first effect of obstruction of the bowel is elongation of the bowel above the obstruction, and that actual dilatation only occur late, after stasis develops. I can conceive that this stasis and its effects, even occurring farther upward in the bowel, may originate in the rectum. This stasis in the rectum likewise may have its origin later in life, and be secondary to depression, shock, intercurrent illness or any conditions which would make the patient ignore the call of nature, or that would blunt the nerves so that greater stimulation would be required to bring about the proper reflex.

Finally in the study of intestinal stasis I believe that in all cases the bismuth meal should be followed through the gastro-intestinal tract but I believe that in all instances there should also be given an enema, and a careful fluoroscopic and roentgenographic examination made in both the supine and vertical postures. This will frequently show the cause of the intestinal stasis, which otherwise the surgeon would have to hunt for or the physician would have to infer.

For instance, the colonic injection will show best the various organic constrictions of the bowel, the effects of the adhesions, the presence of loops it will also be the means of demonstrating the



FIG. 10. Shows colonic stasis, the diverticulitis, in a man who failed to have bowel movement every day, and who was suffering from advanced chronic rheumatoid arthritis.

presence of a patulous ileocecal valve, which is so often indicative of adhesions and commonly associated with chronic appendicitis.

These roentgenographic examinations, when properly and carefully done, require much time and are of considerable expense but they give more definite knowledge of the conditions present and point the way for treatment more clearly. I believe that can be done even by an exploratory operation.



Fig. 8. Shows sigmoid loop which rises to the level of the diaphragm and causes periodic attacks of intestinal obstruction which are usually interpreted as sick bowel action.



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varied sufficiently during the examination, these links can be released.

Obstruction at the sigmoid is more likely to be due to links, adhesions, neoplasms, or twists, occurring in connection with a redundant sigmoid.

Links may cause definite localized obstruction to the oncoming fecal column, but one cannot conclude that such links, or obstructions are absent simply by following a barium meal from the mouth, because of the reverse peristalsis, which may cause this portion of the bowel to be completely empty at the time of examination. I believe that these links more often result from a redundant sigmoid which produces the sigmoid loops, the tops of which may at times reach the diaphragm and when this loop becomes distended with gas it may not only cause a link at the sigmoid flexure but may cause pressure upon the transverse colon and upon the stomach, causing temporary obstruction at these two or three places. In other instances the sigmoid loop may extend across to the right side of the abdomen. Such a loop may be present for a long time without giving rise to symptoms but if the colon

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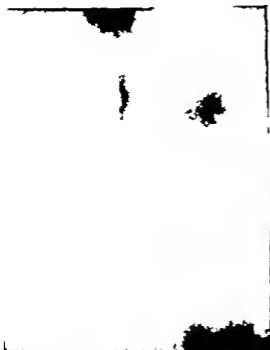


Fig. Anteroposterior view of transplant four months after operation, showing transplant over tenth, eleventh and twelfth dorsal and first and second lumbar vertebrae.



Fig. Lateral view of transplant and spine, showing fracture of last lumbar vertebra with deformity. Radiograph four months after transplant.

of the spinal canal at the junction of the twelfth dorsal and first lumbar vertebrae. (Radiograph shows that this condition is due to crushing of the body of the twelfth dorsal.) The cord compression was relieved by laminectomy on the first lumbar. The cord soon returned to normal fullness and appeared unimpaired. It was punctured with needle and clear cerebrospinal fluid obtained. The wound was closed and dressed. The patient kept absolutely flat on her back supported by adhesive on either side. Recovery was unimpaired. Motor and sensory functions returned normal and there were no bladder or bowel disturbances.

In considering the above treatment conditions and loss of function of this case I think of the usual line of treatment by prolonged confinement to bed with plaster cast jacket or braces to secure immobilization and tension, and the discomfort incident to this method. I decided that internal split by means of strong bone transplant after the method of Albee for Pott disease would give immediate immobilization on support and tension to the injured spine which could be secured no other way. If a secured bony union between the transplant and the pinous process above and below the injury would give the spine a firm support from inside up to the normal. If bony union did not take place the transplant would unite with the ligamentous

structures of the spine and at least furnish temporary immobilization support, and extension.

**Secondary or tertiary operation.** When we are satisfied that the patient had fully recovered from the effect of the injury she was prepared for the secondary operation three weeks after the laminectomy. During this entire time she had remained upon her back and was in good condition. Albee's technique as followed in general in the transplant operation. The original incision was cut through and enlarged above and below. The flaps were reflected back and the spinous processes above the injured vertebra and the spinous processes below the transverse process were exposed. The supraspinous and interspinous ligaments were cut between the transverse processes and then those of the two processes below were cut through and separated from the tops of the spines. The supraspinous ligament over the injured vertebra was cut through and the muscle was separated from the bed for the transplant. The lower prepared spinous processes were split with chisel for a depth of about one inch and, at the same time, the extreme care that the rib, but the third of the spinous process was not fractured.

After preparing the bed for the transplant the flaps were packed with gauze soaked in saline solution and clamped together to protect the wound. The transplant was secured by three-fourths inch with pinous process. The substance was removed from the crest of the rib. The ends of the graft were cut on the distal ends of the edges of bone projecting beneath the skin. The graft could be made three or four inches long.



b

Photo showing degree of flexion with lateral rotation four months after transplant  
 b Four months after transplant showing patient in erect posture  
 Degree of flexion above and below transplant four months after operation

transplant more uniform in size and outline. The transplant was caught and held with two heavy forceps and placed between the split portions of the spinous processes with the peritoneum posterior and the two raw bony surfaces in contact with the two raw surfaces of the spinous processes so the transplant had two chitons—one with each spinous process. The supraspinous ligaments were brought together with interrupted kangaroo tendon sutures which held the transplant firm. The dense tissues were brought together with another row of interrupted kangaroo tendon and the wound closed with deep silk on silk and horse-hair sutures. The cord in the leg was closed with a deep layer of gut and horse hair in the skin. At no time during the operation, as the wound touched with the gloved hand or anything which had come in contact with the gloved hand. The technique was perfect which is necessary in such cases if we are to secure perfect results. The wounds are dressed and the patient again placed on her back in fracture bed with sandbags on both sides. For several days she suffered acutely from pains in the lower extremities with exaggerated patella tendon reflex. This was attributed to a mild form of myelitis resulting from trauma to the cord around the previously injured area. In the splitting the spinous processes with the chisel. Other than this, her recovery was uneventful. She was kept on her back seven weeks after which she was turned on her sides and allowed to move herself in bed. At the end of another ten days she was put in a bed chair and encouraged to exercise, move body and lower limb movements. She left the hospital twelve weeks after the injury able to stand alone and with assistance. At no time has she had braces or support except the regulation style corset which offers no support to the spine. Since the fifteenth week she has walked freely without assistance and has improved steadily so that, as you see, observers would not detect anything abnormal about her walk,

except for the short steps which she takes and slight lurch in the right hand.

Nevertheless she has some limitation of flexion and extension of the spine which must be expected with spinal fixation, but the actions of the spinal ligaments and muscles are not materially interfered with. The range of spinal flexion, extension and rotation, which you can observe, are quite free and far greater than I had hoped for. In fact, I am pleased to state that the results obtained are far beyond my expectations.

#### CONCLUSIONS

All cases of injury to the spine with deformity and paralysis should have an immediate exploratory laminectomy.

1. Bone transplantation as a treatment for spinal fractures and dislocations offers hope to many unfortunates who are now wearing plaster casts, jackets, or braces.

2. The operation is not difficult or dangerous procedure, and, when done as a secondary operation it is not necessary to enter the cord zone in preparing the spinous processes and placing the transplant. A strong bony transplant for an internal splint gives immediate immobilization, extension, and support to the injured spine which can be secured in no other way.

3. A firm bony union of the transplant to the spinous processes above and below the injury gives the injured spine a firm supporting power almost up to the normal.

5 Should a bony union of the transplant to the spinous process fail, the transplant would at least a temporary immobilization, support, and extension to the injured spine which could be secured by no other means.

6 Bone transplantation should be resorted to after laminectomy in most cases of fracture and fracture-dislocation of the spine where the cord is not seriously injured. In the majority of cases it can be done during the laminectomy.

7 It is best to split two spinous processes above and two below the injury to insure union

of the transplant and increase the strength of the spine.

8 The action of the spinal ligaments and muscles are not materially interfered with so a good range of extension, flexion, and rotation of the spine can be secured.

Before closing I wish to extend my thanks to Drs Roy E. Thomas and Willard Smith for their valuable assistance at the two operations. Dr Roy E. Thomas has had charge of the medical care of the case since the injury and has given valuable assistance and suggestions.

## DECORTICATION OF THE LUNG

By RUSSELL S. FOWLER, M. D. F. A. C. S. BROOKLYN

THIS little girl, two years of age, was first seen by me six months ago with a right-sided empyema. A portion of the rib was resected and the cavity drained in the usual manner. In spite of blow-bottles and gymnastics the lung failed to expand. For this reason pleurotomy is now advocated. In lesions of this character it is much better to cause as near as possible a return to normal—that is, by causing the lung to expand—than to attempt to obliterate the cavity by sinking in the chest wall by a Schede operation. In fact, in the whole line of surgical endeavor these methods are most to be advocated which bring the body to normal or as near normal as possible.

Decortication of the lung was first done by George Ryerson Fowler October 27, 1903, while DeBorne's operation—pleurotomy with detachment of the visceral layer of the diseased pleura—was performed by DeBorne in 1904. As this patient is a child it is extremely desirable that as little blood be lost as is possible for this reason the chest is opened rather slowly. The incision is made parallel with the ribs with its center at the old drainage opening. The rib at the seat of the old thoracotomy is removed for a space of an inch, the pericostum being left. The opening in the chest is enlarged to introduce the finger and the cavity explored. It is found that the cavity extends to the apex of the chest posteriorly on this side that below the cavity is bounded by the diaphragm while internally can be felt the pericardium and lung of the opposite side. The cavity becomes smaller toward the apex of the chest. An incision at right angles to the first is made at its posterior

extremity and carried up the chest wall to the third rib. In this case it is not necessary to make an incision in a downward direction as was done in the original decortication operation, though in many cases this original incision is of great use. The arm of the child is carried well over the head, thus raising the scapula out of the way. The flap of soft parts is dissected free from the bony chest wall and retracted upward to the patient's right. As it is retracted the attachments of the scapula are seen to be quite loose, allowing its ready retraction.

The same subperiosteal resection is now made of each rib in turn, proceeding upward and taking out a little less of each rib as we go upward, as the cavity narrows—six inches of the first, five of the second, and so on. All bleeding points are ligated as fast as they occur. We now have the cavity well marked out and covered only by soft parts, the bony structures having been removed. These soft parts are split directly upward, beginning at the center of the old opening into the cavity and extending the full length of the cavity. As each intercostal artery is cut, it is clamped and ligated. The introduction of retractors on either side of the wound now serves to expose the old empyema cavity completely so that it can be viewed in all its parts. It is seen that the apex is narrow. Gauze wrung out of warm saline solution is placed where I am not immediately working to conserve body heat.

We have now come to the main part of the operation. This consists in total pleurotomy—the removal of all of the infected membrane which not only binds down the lung and prevents its expansion, but also from its character would



b

- Photo showing degree of flexion with lateral rotation four months after transplant  
 b Four months after transplant, showing patient in erect posture  
 Degree of flexion above and below transplant four months after operation

transplant more uniform in size and outline. The transplant was caught and held with two heavy forceps and placed between the split portions of the spinous processes with the peritoneum posterior and the two raw bony surfaces in contact with the two raw surfaces of the spinous processes, so the transplant had two chances to unite with each spinous process. The supraspinous ligaments were brought together with interrupted kangaroo tendon sutures.

Each held the transplant firm. The dense tissues are brought together with another row of interrupted kangaroo tendon and the wound closed with deep sutures and horse hair sutures. The wound, the leg was closed with deep layer of gut and horse hair in the skin. At no time during the operation was the wound touched with the gloved hand or anything. Each had come in contact with the gloved hand. The technique as perfect which is necessary in such cases if there are perfect results. The wounds are dressed and the patient again placed on her back as fracture bed with sandbags on both sides. For several days she suffered acutely from pains in the lower extremities with exaggerated patella tendons. This was attributed to mild form of ankylosis resulting from trauma to the cord around the previously injured area. Help splitting the spinous processes with the chisel. Other than this her recovery was untroubled. She was kept on her back seven weeks after which she was turned on her sides and allowed to move herself in bed. At the end of another ten days she was put in wheelchair and encouraged to increase torso body and lower limb movement. She left the hospital in three weeks after the injury able to stand alone and walk with assistance. At no time has she had braces or support except the regulation style correct back offers no support to the spine. Since the fifth month she has walked freely without assistance and has improved steadily so that as you see, observers would not detect anything abnormal about her walk.

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Necessarily she has some limitation of flexion and extension of the spine, which must be expected with spinal fixation, but the actions of the spinal ligaments and muscles are not materially interfered with. The range of spinal flexion, extension and rotation which you can observe are quite free and far greater than I had hoped for. In fact, I am pleased to state that the results obtained are far beyond my expectations.

#### CONCLUSIONS

1. All cases of injury to the spine with deformity and paralysis should have an immediate exploratory laminectomy.

2. Bone transplantation as a treatment for spinal fractures and dislocations offers hope to many unfortunates who are now wearing plaster casts, jackets, or braces.

3. The operation is not a difficult or dangerous procedure, and, when done as a secondary operation, it is not necessary to enter the cord zone in preparing the spinous processes and placing the transplant. A strong bony transplant for an internal splint gives immediate immobilization, extension, and support to the injured spine which can be secured in no other way.

4. A firm bony union of the transplant to the spinous processes above and below the injury gives the injured spine a firm supporting power almost up to normal.

5 Should a bony union of the transplant to the spinous process fail, the transplant would give at least a temporary immobilization, support, and extension to the injured spine which could be secured by no other means.

6 Bone transplantation should be resorted to after laminectomy in most cases of fracture and fracture-dislocation of the spine where the cord is not seriously injured. In the majority of cases it can be done during the laminectomy.

7 It is best to split two spinous processes above and two below the injury to insure union

of the transplant and increase the strength of the spine.

8 The action of the spinal ligaments and muscles are not materially interfered with, so a good range of extension, flexion, and rotation of the spine can be secured.

Before closing I wish to extend my thanks to Drs Roy E. Thomas and Willard Smith for their valuable assistance at the two operations. Dr Roy E. Thomas has had charge of the medical care of the case since the injury and has given valuable assistance and suggestions.

## DECORTICATION OF THE LUNG

B. RUSSELL S. FOWLER, M. D., F. A. C. S., BROOKLYN.

**T**HIS little girl, two years of age, was first seen by me six months ago with a right-sided empyema. A portion of the rib was resected and the cavity drained in the usual manner. In spite of blow-bottles and gymnastics the lung failed to expand. For this reason pleurotomy is now advocated. In lesions of this character it is much better to cause as near as possible a return to normal—that is, by causing the lung to expand—than to attempt to obliterate the cavity by sinking in the chest wall by a Schede operation. In fact, in the whole line of surgical endeavors those methods are most to be advocated which bring the body to normal or as near normal as possible.

Decortication of the lung was first done by George Ryerson Fowler, October 27, 1891, while DeBorome operation—pleurotomy with detachment of the visceral layer of the diseased pleura—was performed by DeBorome in 1894. As this patient is a child it is extremely desirable that as little blood be lost as is possible for this reason the chest is opened rather slowly. The incision is made parallel with the ribs with its center at the old drainage opening. The rib at the seat of the old thoracotomy removed for a space of six inches the periosteum being left. The opening in the chest is enlarged to introduce the finger and the cavity is explored. It is found that the cavity extends to the apex of the chest posteriorly on this side that below the cavity is bounded by the diaphragm, while internally can be felt the pericardium and lung of the opposite side. The cavity becomes smaller toward the apex of the chest. An incision at right angles to the first is made at the posterior

extremity and carried up the chest wall to the third rib. In this case it is not necessary to make an incision in a downward direction as was done in the original decortication operation, though in many cases this original incision is of great use. The arm of the child is carried well over the head, thus raising the scapula out of the way. The flap of soft parts is dissected free from the bony chest wall and retracted upward to the patient's right. As it is retracted, the attachments of the scapula are seen to be quite loose allowing its ready retraction.

The same subperiosteal resection is now made of each rib in turn proceeding upward and taking out a little less of each rib as we go upward, as the cavity narrows—in inches of the first, five of the second, and so on. All bleeding points are ligated as fast as they occur. We now have the cavity well marked out and covered only by soft parts the bony structures having been removed. These soft parts are split directly upward beginning at the center of the old opening into the cavity and extending the full length of the cavity. At each intercostal artery is cut it is clamped and ligated. The introduction of retractors on either side of the wound now serves to expose the old empyema cavity completely so that it can be viewed in all its part. It is seen that the pericardium is narrow. Gauze wrung out of warm saline solution is placed where I am not immediately working to conserve body heat.

We have now come to the main part of the operation. This consists in total pleurotomy the removal of all of the infected membrane which not only binds down the lung and prevents expansion, but also from its character would



Fig. 1

Fig. 2

tibial tendon to it this bone I tilted upward relatively producing a subluxation at the calcaneocuboid and the astragaloscaphoid articulation and the angle at the junction of the tarsus and the metatarsus, increased producing a higher arch of the foot than normal. The pain resulting from this condition is due to the irritation in the muscle it being manifested in the muscle and referred to the insertion of its tendon. It is also due to the strain produced in ligaments which enter into the composition of the mediotalar joint.

The deductions as to the mechanism of the condition above outlined have been drawn from clinical observations. As a further evidence of the *modus operandi* of the altered muscle balance and function more or less frequently encountered in patient suffering from pain in the tarsus Dr. P. G. Skillern, Jr. found in the dissecting room of the University of Pennsylvania Medical School a condition of unilateral subluxation of the mediotalar joint of apparently static origin. He was then investigating the mechanism and results of traumatic luxation simultaneously with the writer study of the static causes and conditions of subluxation of the joint. The specimen was carefully studied to determine the etiological factors and mechanics of the abnormality and the facts obtained

supported the opinion that static subluxation had developed during life. Two other specimens were found and carefully investigated. Further study by comparison with specimen not showing result of pain or luxation and feet of patients was continued to ascertain whether posterior tibial contractions and mediotalar subluxation were due to post mortem condition. It was found a same that *rigor mortis* was not responsible for this condition found in the specimens, because the posterior tibial under study were shortened and the other muscles were not affected also in other specimens in which there was a rapid condition all the muscles were affected alike.

The anatomical specimens the fact gained by post mortem study and the clinical data were submitted to Dr. George A. Piersol, Professor of Anatomy in the University of Pennsylvania whose opinion was that the contractions of the posterior tibial under these circumstances were not due to post mortem changes.

*Post mortem study.* Careful dissection was made of the specimens under investigation preserving all the muscles, their tendons, and the joint ligaments. The first specimen (Fig. 1) showed a considerable degree of subluxation. The antitarsus was depressed below the normal line of the foot. It was adducted the arch being considerably increased and a moderate degree of *grus* was

## TRAUMATIC APHASIA

## REPORT OF A CASE

B. H. A. HAUBOLD, M.D., New York City

Surgeon to Harlem Hospital

**P**RESSURE on a circumscribed portion of the brain due to trauma, and attended by loss of a special sense is comparatively rare. We have learned to consider that injury of the cranium sufficiently violent in character to cause paralysis usually also means an increase in the general intracranial pressure which provokes a symptomatology giving the picture of so-called cerebral compression sequentially manifested by irritation, convulsions, impairment of consciousness, and coma. As a rule, finer distinctions with regard to the localization of solution of continuity of parts and their localization are rendered impracticable being masked by a rapid upsurge of general cerebral function.

The decompressive operation, so-called is at best an uncertain quantity when applied to cases where a symptomatology of general cerebral compression follows severe trauma to the cranial contents. Operative effort at relief in severe cases of cerebral compression is justifiable procedure and is frequently enough followed by successful outcome. Despite the valuable assistance of the radiogram and a careful study of the clinical picture however the surgeon approaches with some hesitance the problem of opening the skull in this class of cases in the absence of focal symptoms which would of course determine the area of attack.

The case reported herewith presented a picture so entirely at variance with that which usually obtains in lesions of the brain due to trauma that it would seem to justify burdening still further the literature with presentation of a phase of the problem which is distinct in many regards.

The patient whose case is here recorded was found by the writer walking around the ward in Harlem Hospital. The house surgeon explained that the patient was under arrest, the result of a phase of the problem which is distinct in many regards.

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The report of the examination made by the house staff

showed no abnormality beyond the ecchymosis and the slight scalp wound mentioned above. Nor indeed did the examination of the patient elicit other symptoms beyond the fact that the patient made manifest effort to speak. It was clear that the man was not shamming. It was equally clear that he understood what was said to him. His efforts at speech in response to questions both in Italian and English were attended with great labor. Onomatopoeic language was able to get him from dictation in both languages and ultimately his diagram (see exhibit) to express himself caused him to break down completely. All other cerebral functions were keenly left and indeed taking into account the man's unusual physical development the one lost function stood out in striking contrast.

A diagram taken by Dr. William H. Stewart (Fig. 1) shows a fracture transversely one and one-half inches back from the anterior end of the zygoma, faint transverse at first, then slightly curving upwards. Dr. Stewart indicated the fracture by the arrowheads above in the reproduction of the radiogram. At the time the shadow picture was taken the patient was positioned with the left side of the skull toward the film side of the negative. The point of course reverses the attitude.

Dr. Stewart as indicated before, that the fracture was on the left side of the skull and involved the squamous plate of the temporal bone. The patient does not feel qualified to make his deductions in the interpretation of radiograms and from a clinical standpoint the simple existence of fracture of the skull was of great assistance more so in most instances solution of continuity of bone in the cranium due to trauma is very properly regarded as a burning fact, rare following certain physical lesions that are not yet susceptible of application in the given case.

It is regarded certain that deformation of the cranium, the result of fracture, displacement of fragments was not the cause of the loss of function, concussion arranged by the upper arm was displayed by the radiogram. In this connection noted the results of the radiogram.

Fracture of the skull as shown in the illustration was not discovered at the time of the operation, though the area of exposure involved the bone. Here the fracture as supposed to be. This would seem to indicate that the bone lesion shown as on the side of the skull opposite the traumatized brain area and did not stand in causative relationship to the aphasia. The writer as indicated before, the bone injury (if any) responsible for the clinical picture is located elsewhere and as probably situated at the base of the skull.

Dr. Martin Cohen examined the patient and reported as follows:

March 26, 1914. Examination of fundi. Right disc color normal. Marginal half slightly indistinct and blurred. Vessels not slightly tortuous. Arteries normal. Left disc color normal. Marginal blurred. Vessels, and arteries normal. Diagnoses: Mild grade of optic neuritis (bilateral). This could seem to indicate an intracranial injury.

Operative effort seemed justified by the motor aphasia, the evidence of fracture as shown by the radiogram, and the ophthalmoscopic findings.



Fig. 12. Shows complete continuity of lower lung retracted, filling chest cavity.

continue to cause infection if any of it were left. The incision into this tissue is not begun on the lung itself for if so done injury to the lung would be harmful and but beginning with the parietal pleura a start is made and a line of cleavage found which will allow of the stripping of this membrane not only from the parietes but also from the lung. This is a tedious or peeling process is facilitated after having partly separated the parietal pleura by catching the edge with clamps by slight traction on the clamps the peeling process is continued with blunt curved scissors. Only here and there will a tug of the scissors be necessary for the most part the peeling can be done by blunt dissection. As the lung is approached it is found that the decortication is easier though here and there little area of more dense inflammation will render injury to the lung easy. In this case we were particularly fortunate in being able to strip the pleura with comparative ease the pleura being removed in one broad sheet. This is not always possible in many cases it is necessary to remove the pleura in strips, and in

some cases in which it was found impossible to avoid injury to the lung I have been compelled to abandon the operation temporarily until the visceral injury had healed. Here as we proceed, we find that the lung has been entered in one place. Failing to close this with a fine catgut suture a strip of warm saline gauze is held against it while the operation is proceeded with. Again, a little lower down, the lung is injured and the same procedure with warm saline gauze is employed.

It is seen that even in spite of these small injuries the lung is beginning to expand and fill the cavity. The pleura has now been removed in almost its entirety. There remains but a small area of pleura at the apex of the chest wall which in this case is almost impossible to remove. With the scissors this surface is scoured and as much of it lining removed as possible. With the warm saline gauze strips in place against the site of injury to the lung the soft part of the bony chest wall are now replaced and accurately sutured so as to insure the continuity of the ribs which will be reformed by the periosteum which has been left in place. To provide for the huge wound discharge which follows this operation, a rolled up drain of green silk protected is introduced to the apex of the chest on that side and emerges from the original thoracic wound, the edges of this latter being excised. The oropharyngeal flap is now accurately sutured except at the point where the drain emerges.

**Idiogram.** The after course of this case is interfused with infection of the wound edges requiring the removal of the stitches on the fourth day. Following the removal of the stitches the flap was trapped in place with adhesive plaster and finally good primary union was secured. At the time of the removal of the sutures the drainage strip was removed and replaced by a rubber tube at the lower angle of the chest. The X-ray picture (Fig. 13) reveals the continuity of the chest to be complete showing that the suturing at the time of operation must have been accurate. This picture was taken sixteen days after the operation. The picture also shows the lung expanded and filling the chest cavity.

# TRACHEOTOMY A NEW RETRACTOR AND TUBE PILOT FOR THE EMERGENCY OPERATION

BY FRANK LE MOYNE HUPP A. M. M. D. WHEELING WEST VIRG. LA.

Surgeon to the Ohio Valley General Hospital

THE tracheotomy tube was used by that capable and daring Byzantine surgeon, Paul of Aegina A. D. 690 it was used by the medical men at Pompeii, so it is no new story we bring to you to day. Far be it from the writer to suggest anything which might lead to a complication of the simple methods of this very old operation of opening the windpipe.

Fehr Lejars (1) has described tracheotomy as the type of those urgent operations which every practitioner should be prepared to do at any time, in any place, and if necessary with extemporized instruments. Since the advent of the serum treatment of diphtheria intubation and upper bronchoscopy the indications have become much less frequent, but if less often required in cases of diphtheritic laryngitis, it is still urgently necessary for certain injuries, burns, and foreign bodies in the larynx; in edema of the glottis following extensive phlegmons of the floor of the mouth the larynx, and the pharynx, or following certain severe types of acute laryngitis or secondary to cancer of the tongue or tonsil to retropharyngeal or tonsillar abscess, or to Ludwig's angina or woody phlegmon (Powers) in tuberculous or cancer of the larynx, in which cases the necessity often arises very suddenly during the course of an unexpected attack of suffocation. Indeed the indications can be summarized in two words laryngeal asphyxia.

The status of tracheotomy in its relation to obstructive diseases of the upper air passages, particularly croup before O'Dwyer bequeathed to humanity that priceless legacy intubation, can best be appreciated when we reflect that of 183 250 cases treated in 50 cities before the combined use of antitoxin and intubation the mortality was 35.4 per cent whereas the result since the introduction of serum, is in 13 548 cases, omitting those not treated with serum a mortality of 9.8 per cent (Rosenthal Oeder). It was the earlier difficulties and surgical tragedies attending the operation of tracheotomy that inspired the inventive genius of O'Dwyer for when once asked what led to the creation of his tube he replied, Complete failure with tracheotomy in the New York Foundling Hospital extending over period of several years.

The lamented William K. H. Simpson ( )

late Professor of Laryngology in the College of Physicians and Surgeons, New York has said that the horrors and difficulties incident to the operation of tracheotomy in young children and above all the many fatalities, caused an abhorrence alike on the part of both parent and physician to the extent that the latter gladly delayed surgical interference as long as possible and in many quarters the operation was practically abandoned and the little ones allowed to die after the gamut of non-surgical methods had been run. Certainly the delay due to this great dread of tracheotomy was itself largely accountable for the fatality attending its performance for it was a brave surgeon who would tracheotomize in the earliest stages of laryngeal croup.

While it is well known that the real battle of intubation was waged and its glories won before the days of antitoxin it is also a matter of knowledge that since the discovery of the Klebs-Loeffler bacillus and the introduction of the serum antidote, the tubes of O'Dwyer and the tracheal cannula so far as their use in membranous croup is concerned, have almost been relegated to the relics of surgical armamentaria.

It seems to be the consensus of opinion among laryngologists that the intubation tube cannot always be depended on. In preparing for the relief of a case of laryngeal asphyxia one should, therefore always be prepared for tracheotomy (Brewer (3)). An undrained tube may be dropped into the trachea or a piece of diphtheritic membrane or other obstructing substance may be pushed in front of the tube and thus accentuate the symptoms to the point of suffocation.

Another danger suggested by Brewer and not infrequently encountered in the operation of intubation necessitating quick tracheotomy is the sudden collapse due to the inhibition of the cardiac and respiratory centers, from the irritation of the mucous membrane at the superior aperture of the larynx.

Several years ago recognizing the high rate of mortality attending the operation of opening the trachea having personally suffered the experience of two fatalities before the operation was completed, and realizing the imperative need for some retractor and tube guide which might be



Fig. Fracture indicated by arrowheads

The operative procedure did not deviate materially from that usually employed for the purpose. An omega-shaped flap consisting of scalp and pericranium was fashioned over the speech center on the left side. A fracture as found at this point though this on the grounds already stated, did not constitute a deterrent with respect to further procedure.

The skull was opened with the Doyne drill and burr and the opening enlarged with the rongeur forceps. The writer preferred that method in this instance to the osteoplastic exposure on the ground that it seemed probable that only restricted areas of brain tissue would need to be exposed and that the extent of bone trauma involved in making an osteoplastic flap could perhaps be greater than necessary for the purpose.

The exposed dura did not pulsate. There was no extradural hemorrhage found. The total area of exposure was about  $\frac{3}{4}$  by  $\frac{3}{4}$  inches in size.

When the dura was opened with craniotomies, about two ounces of thick smeared blood escaped. A partially coagulated layer of blood was removed from the under surface of the dura corresponding to the third frontal convolution and island of Reil. The brain immediately pulsated synchronously with the cardiac systole however blood continued to ooze from the inferior surface of the brain. It is probable that the bleeding came from torn basal veins or an unusually large emissary of Santorini the result of fracture of the base of the skull.

A slender piece of sterile gauze was turned downward toward where the bleeding seemed to come from, though this did not entirely prevent the oozing of blood. The extracranial portion of the gauze was packed into the opening in the bone and the scalp held in position by interrupted silk suture sutures.

A cerebral anesthetic followed the procedure except that the bleeding during the twenty-four hours following the operation was greater than usually obtains in cases of this sort.

Twenty-four hours later, forty-eight hours after the operation, the patient was again narcotized and the packing carefully removed.

The bleeding had ceased and the wound was closed in the usual manner.

Up to this time there had been no improvement in the man's speech but the day following removal of the gauze the patient began to speak Italian and could repeat few words of English.

At this time Dr. Cohen made second ophthalmic examination with the following result:

Examination of fundi. Right disc, normal in relief, margins distinct. Vessels normal. Left disc normal in color. Margins more distinct than at previous examination. Vessels, cross and arteries normal. Diagnosis. Distinct improvement in margins of disc in both eyes, lenses receding.

From this time on the patient made an uninterrupted recovery, reaching about his normal range of speech in both Italian and English in about seven days following the primary operative procedure. If the six days during which the speech area was subjected to gauze pressure be deducted it may be said that restoration of the normal occurred in about five days.

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Fig. Fracture indicated by arrowheads

The operative procedure did not deviate materially from that usually employed for the purpose. An orange-shaped flap consisting of scalp and pericranium was fashioned over the speech center on the left side. A fracture was found at this point though this, on the grounds already stated, did not constitute a deterrent with respect to further procedure.

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To those interested in the subject of chronic obstruction of the larynx and trachea we would refer them to the excellent papers by Dr John Rogers

There are cases of the gravest emergency where suffocation is imminent cases demanding rapidity of execution where the trachea must be opened before the bleeding can be arrested

We have all, as Brewer has described seen large quantities of blood aspirated into the trachea and bronchi by the first spasmodic respiratory act causing complete cessation of respiration Here the sufferer may be resuscitated by the prompt use of the instrument here described, quickly followed by the introduction of a soft rubber catheter to the tracheal bifurcation with suction artificial respiration, and wide retraction of the severed rings The bleeding from the most part from the inferior thyroid vein is quickly relieved the moment air enters the tracheal opening

There is probably no operation in surgery where hurry excitement and fear of death are answerable for so many accidents as in the emergency operation of opening the windpipe Not one of these accidents should be charged up to the anatomical conditions Here certainly while speed is imperative a clear brain and a steady hand are likewise indispensable It is a mistake to say as Lejars has pointed out that the operation can be done in three perhaps this is true for operators who have had special experience for the interests of soundling hospital but for the average practitioner the operation of opening the windpipe always a delicate surgical procedure particularly the emergency operation whether it be the writhing and blue child with foreign body or Klebs-Loeffler membrane or the flt choking and congested adult It was with a few inducing a minimum of difficulty and the hope of lowering the mortality that the operation in these emergencies is that required the first

#### GENERAL PRINCIPLES

Local anesthesia if possible or combined ether anesthesia and local infiltration if no other and adrenalin dropping Cric. as my opinion that inhalation anesthesia does not preclude any impulse of emergency hanging the be a call and making them discharge the nervous energy patient all day covered the last degree and fl but shocked to death

While the tal be set it open the first be set in it remember your anatomical hurry be calm and keep your hand

3 Shoulders raised, head extended and immobilized by the two hands of an assistant

4 Chin rigid and in line with episternal notch (Trevs [5])

5 Even retraction from mid-line

6 Remember that the hemorrhage from venous engorgement and blocked right heart are relieved the moment the trachea admits air

7 When suffocation is imminent be satisfied with touch do not wait for a sight of the white rings before tracheal incision

8 While desirable to control bleeding before opening the trachea delay in accomplishing this may sometimes block the heart and cost a life

9 Cut cautiously the soft collapsible rings of an infant's trachea it is but a line or two from the oesophagus

10 After treatment of tracheotomized patient is of imperative importance no case should be left without skilled care In diphtheritic stenosis the danger time is within forty-eight hours after the exhibition of antitoxin when the membrane begins to loosen

#### CLAIMS FOR THE NEW RETRACTOR

1 Laryngeal asphyxia from any cause may be relieved with this instrument and a penknife

2 It will guide a cannula quickly safely and with accuracy into the trachea in the presence of copious mucous bleeding

3 In a short flat neck with suffocating dyspnea, relief may be given with expedition

4 It is a useful and safe instrument in the hands of the general practitioner

5 Where a second operation must be done in the presence of cicatricial tissue and through inflamed tissues with the aid of the retractor one can enter the windpipe without difficulty

6 Where the tracheal tube has been coughed out or has slipped for any reason this retractor is a useful instrument for quick and painless re-placing of the cannula without anesthetic or cutting

We earnestly trust that the little life-saving instrument will give proof of our object in designing it that it lessen the difficulties of others that has lessened ours and prevent the tragic ending of some emergency tracheotomy

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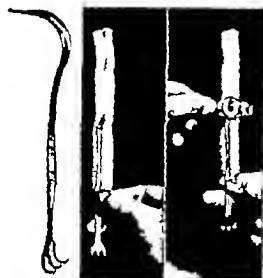


Fig. 1

Fig. 1. Tracheal retractor and tube pilot.



Fig. 2

Fig. 2. Separating and separation of tracheal ring.



Fig. 3

Fig. 3. Retractor action on tube pilot.



Fig. 4. Cannula about to be introduced with the help of the tracheal retractor.

pape wound. The tracheal incision is now wide open and with an expulsive cough the asphyxiated patient is relieved.

If there is no tracheal cannula at hand, and no other cutting instrument but a penknife, with the aid of this instrument a patient may be kept alive and comfortable indefinitely until the metal cannula arrives or a cannula may be improvised from rubber tubing, the vital necessity of making an opening into the trachea and letting the air enter at once having been accomplished.

Several cases of urgent dyspnea due to laryngeal or tracheal stenosis have come under the writer's observation. Two were relieved by tracheotomy performed with no other instrument than the emergency retractor and a penknife. Both patients were in the act of suffocating, one from a retropharyngeal abscess, another resulting from laryngeal tetanus due to diphtheria. The third was a case of post-typhoid laryngeal stenosis who had been tracheotomized some weeks before and when the tube was removed there was a return of all the distressing and urgent dyspnea. In the latter case there was a complicating peritracheal abscess and a mucopurulent bronchobronchitis. Dissection was out of the question; a quick stab was made through the old cicatrix without an anesthetic and this retractor plunged through the sloughing sinus. Fortunately the trachea was entered, and after the escape of several ounces of yellow, foul-smelling, mucopurulent material, relief was immediate. This case, as seen by my colleagues on the staff of the Ohio Valley General Hospital and has since been studied by my friend Dr. Chevalier Jackson of Pittsburgh, and has not been heard from he was still carrying a tracheal tube

quickly and efficiently placed we devised an instrument for this emergency procedure and an account of it appeared in the New York Medical Record (4). Our policy for again bringing this instrument to the notice of the profession is that we have modified its form, thus adding materially to its scope of usefulness.

This tube pilot or emergency tracheal wound retractor is fashioned like a miniature Sims speculum, as may be seen by the photograph, terminating in a probe-point, grooved on its convex side like the Sims instrument, but fashioned so that the two sides converge toward the probe-point. The retracting device placed at right angles to the handle and for convenience we have added a three-pronged tractor at the other end of the shaft.

When the tracheal ring or rings have been cautiously divided (too frequently happens, just as an effort is made to push the cannula) that the severed rings, either through aspiration or pressure are inhaled or, perhaps, as we have more than once observed, the cannula has slipped into the cellular tissue or the imperfectly divided fascia outside of the trachea, and the patient quits breathing. I just such an emergency this probe-pointed guide and tracheal wound dilator may be quickly but with precision and in a deliberate way carried along the finger and forced through blood, if present into the wind-



Fig. 1



Fig. 2

present. On the dorsum of the foot a large portion of the joint surface of the head of the astragulus could be felt under the joint capsule and its prominence could be easily seen. Under the ligament on the dorsal and plantar aspect of the foot the margin of the calcaneocuboid articulation showed about one third degree of luxation. This condition was found when the foot was allowed to rest in a position in which gravity or other stress played no part in the mechanical factor. Strong force was then applied to dorsally flex the foot and the joint surface of the astragaloid head and the luxated joint surface of the calcaneus at its cuboidal articulation changed their relative positions only in a slight degree. The calcaneo-caphoid and alar cuboid ligament were contracted it being necessary to divide the ligament in the specimen before complete reduction could be accomplished.

Following this the tibia and talus were cut at the same flexing force applied with practically no more change in the joint surface relationship than was first observed. Again the tendon of the long flexor of the toes were cut and the same flexing force applied and the relation of the joint surfaces remained the same. The tendon of the peroneus longus was then cut and the flexing force applied and the degree of luxation was not

further reduced. Finally the ligamentous band over the tendon of the posterior tibial below and posterior to the internal malleolus were dissected away (Fig. 2) in order to remove the tendon from its groove to release its action and to preserve the entire muscle. When the tendon was slipped out of its groove and the flexing force applied (Fig. 3 and 4) then both the astragalo-caphoid and calcaneocuboid joint surfaces easily moved into their normal relationships. When the tendon was replaced into its groove below the internal malleolus and dorsal flexion attempted the same relationship existed as first described (Figs. 1 and 2). Fig. 4 shows reduction of subluxation in the astragalo-caphoid joint when the posterior tibial tendon has been removed from its groove.

A radiograph was made of the specimen (Fig. 5) with the same dorsally flexing force applied with the posterior tibial tendon in its groove below the internal malleolus and the same condition of subluxation of the joint remains as was observed to be present in other test. By comparison the relationship of the joint structures in the specimen bears a striking resemblance to the same structures shown of the living foot (Fig. 6). About 50 subjects or 100 feet were observed in the dissecting room and about two per cent exhibited the condition herein described.

## AN UNUSUAL LACERATION OF THE FEMALE URETHRA

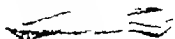
B. SIGFRIDO FIGUEROA, M. D. Mexico, Mexico

THE following case deserves to be reported, as it was one of a longitudinal laceration occurring during a miscarriage.

The patient, woman of Míya Tocha descent, forty-seven years old entered the gynecologic ward of the Hospital O'Hernández complaining of inconsequence of urine ever since a miscarriage occurring about twelve years ago. Her family history was negative. She had seven normal deliveries, but her eighth pregnancy ended by abortion at the fifth month, being attended during her delivery by a midwife who extracted the foetus manually. Shortly afterward and ever since she complained of pain and burning sensation at the vulva and noticed that her urine dribbled out continuously.

Upon examination, I found a thick conical projection of mucous membrane of about an inch in length, hanging down from the distal portion of the anterior vaginal wall, with which it was connected by its broad base. As the accompanying figure clearly shows it had apical or posterior face and vestibular or anterior face. About the upper third of the posterior face there could be made out the vaginal tubercle, and on its anterior face a shallow groove, running from its tip to its base could be seen. The vestibular sacrum appeared enlarged and covered by very small papillary projections giving it a velvety appearance. The clitoris was easily located but one thing was striking and it was the absence of the urethral opening in its normal location, being occupied by the anterior end of a groove shallower than the one already described and which ran backwards and upwards to meet its posterior end. The angle formed by the meeting of the two grooves was occupied by a small excrescence very much like urethral caruncle, around which the urine could be seen flowing continuously. With these findings I diagnosed longitudinal laceration of the urethra and urethral caruncle. I removed this one and for the laceration I performed plastic operation.

This case merits some consideration, as the urethra by its position under the pubic arch and its dense fibrous connections with the surrounding structures is protected from direct violence, at least in its distal extremity and any undue



Case of longitudinal laceration of the female urethra

traction exerted upon it would naturally tend to drag it downward and backward rather than to tear it longitudinally. A distention of the urethra would expose it to a tear as the one described by being caught accidentally by the attendant's fingers, and probably this was the etiology of the present case.

## SPLENECTOMY FOR PRIMARY PERNICIOUS ANÆMIA

### PRELIMINARY REPORT OF TWO CASES OPERATED FOR THIS DISEASE

B W W ROBLEE N D RIVERSIDE, CALIFORNIA

**CASE** W. T. S. <sup>plumber</sup> aged 4. Family history: Mother died at age of 68 of pernicious anemia. Father died at 70 of cerebral degeneration, the exact nature of which was undetermined. History of any constitutional disease affecting other members of the family. Personal history good, has not been absent from work more than one or two days at time for twenty-five years preceding present illness.

Proventriculus began empty on 9 g with progressive weakness, pallor, loss of appetite and mental depression. First saw him August 28. 9 g found pale depressed weak individual. He had no appetite, some regurg and other rather vague symptoms referable to the gastrointestinal tract. A test meal showed hydrochloric acid somewhat diminished, no blood, excess debris or Bacteroides bacilli.

Urine normal, both in amount and chemical reaction  
Blood Hemoglobin, 90 per cent erythrocytes 300,000  
14 marked poikilocytes great variation in size  
poikilocytes present but cells 6,000 with normal  
differential count percentage Spleen slightly enlarged  
lower edge convex lower costal border 1 or 2 cent  
higher, and lungs as normal findings upon physical  
examination

**Diagnosis:** Primary petriolaris syndrome although cancer of the stomach could not be positively ruled out.

Treatment: Diet by direction and internally, astringents, hypodermically, and careful forced feeding. He gradually improved. The blood findings approached but never quite reached the normal and on January 24 he came back to work. He was not able to get on full time in March. He was obliged to get up less often again. He grew rapidly worse and for 6 weeks before his operation he was confined to bed. His stomach was very irritable not only as he unable to eat freely on account of nausea but for many months he was very tired and deteriorated. He was dependent had given up hope of recovery and as expecting the soon blood count May 6 500 000 and retic.

**Operation May 8.** Abdomen opened by left rectus abdominis, stomach splenicoduodenal and liver found & free from any growth. Splenectomy under elastic anasthesia - operation so uneventful. Patient left the table in no condition of shock. He suffered for 2 days from nausea & occasional vomiting until from that time on he gained rapidly in a justifiable strength color and spirits. Left the hospital on the fifteenth day, all of the above scars in the abdominal cavity faded and each day was a more steady gain. The most noticeable change - while from the 11 and posture was in his direction and spirit. 11 days after the fourth day - out freely of every thing his spirit was exuberant he eat more than three times as much as before and from nothing he had gained 25 lbs. He has become again a person of delight in his good work. He has also banished from depression hopelessness and what from both simple could and be cured. cheerful happy husband and father. He feels that he is going into life of one in his world. 11 promises of patients are fulfilled. He is in the hands of the staff.

the procedure certainly accounts for much of the mental immaturity.

About the middle of June he began to have colicky pains in the abdomen. These seemed to have their origin in the splenic region. They became gradually more severe and he was again confined to his bed. There was no vomiting or obstruction but the peristaltic tugings could be distinctly observed through the abdominal wall in this region. On July 20 he opened the abdomen, and found the transverse and splenic flexure of the colon adherent to the abdominal wall at the site of the operation scars. These adhesions were relieved. He had very little discomfort from this, and has been comfortable and steadily gaining since that time. The rich deep red color of the blood at this operation as so marked contrast to the condition observed the first time the abdomen was opened.

*Pathological Report* (Dr T R Griffith) Spleen, 220 g contains normal capsule and trabeculae somewhat thickened, pigment greatly increased, power of contraction.

**Blood Examination**  
 May 6-94 Red cells 500,000 30 per cent hemoglobin 40 per cent color index 4 Stained erythrocytes Polychromatophilic leukocytes 70 per cent lymphocytes 8 per cent eosinophils per cent

There are present normoblasts, megaloblasts, macrocytes, monocytes and marked poikilocytosis.

All y. Kid cells 64,000 (3 per cent) hemoglobin 40 per cent, color index . . .

This examination made four days after the operation for extirpation of the spleen. The stained specimen showed practically the same picture as in the first examination.

31 36 Red cells, 400 000 ( 3 per cent) leucocytes  
8 000 haemoglobin, 50 per cent color index, 7

Stained specimens showed very much less polychromy than normal and the red cells are more uniform in size. There is marked degeneration of the red cells and great increase in the number of normoblasts.

June 3. Red cells . . . 1,000,000 (4 per cent) hemoglobin  
80 per cent color index

Stained specimen shows about the same that of  
VI 3 26

There were no megakaryoblasts observed.

The staining qualities of the red cells were much more uniform, and the fragmentation of the red cells was much less and was confined to the larger cells.

I believe the small cells came from the breaking off of the peripheral processes of the red cells as they were passing at state of polychromatocytes, the size of the fragments accounting for the size of the cell observed.

The fragmentation of the center of the larger red cells probably was due to failure of the tumor to furnish soon enough an adequate graveyard for those cells which had outlived their usefulness, on base of the spleen which is no longer there to perform its function.

Case 3. J. B. White, aged 57. Had never been seriously ill, no cancer history. Began to fail during the spring of 1913 was unable to do any work during the summer and winter, came under my care at the Riverside County Hospital, February 7, 1914. Patient was pale and listless, and complained bitterly of pains in the legs, bones, especially the tibia. Wassermann test negative. Stomach contents showed slight decrease of hydrochloric acid, urine normal. Blood: Hemoglobin, 65 per cent; erythrocytes, 1,500,000; whites, 6,000.

Operation, May 7, 1914, under ether anesthesia. Left rectus incision, stomach, duodenum, and liver showed no evidence of disease. Splenectomy performed. Patient left the table in good condition and developed no post-operative shock. Began to eat freely on second day and has eaten fairly well since. Has gained in strength and at the end of one month was able to walk up and down stairs and in wet of bed the greater part of the day. The improvement in color of cheeks, fingers, and other cutaneous surfaces was very marked within the first week and has slowly improved since. The general improvement was much more pronounced during the first two weeks than it has been since that time. The results in fact do not warrant an enthusiastic prognosis, and we are less hopeful of permanent results in this case than we are in Case 2.

*Pathologic Report* (Dr. T. R. Griffith). Spleen slightly smaller than normal, measuring 127 x 75 cm. pigment increased, otherwise normal appearance.

#### Blood Examination

May 9, 1914. Red cells, 500,000 (5 per cent) hemoglobin, 65 per cent, color index.

May 5. Red cells, 450,000 (5 per cent) hemoglobin, 65 per cent, color index.

May 10. Red cells, 400,000 (5 per cent) leucocytes, 6,000 hemoglobin 65 per cent, color index.

May 7. Red cells, 500,000 (5 per cent) hemoglobin, 65 per cent, color index.

June 24. Red cells, 4,500,000 hemoglobin, 60 per cent.

July 6. Red cells, 850,000 hemoglobin, 85 per cent.

The stained specimens gave very much the same picture as in Case 2. There were normoblasts, megakaryoblasts, macrocytes, microcytes, and marked polychromatocytes.

After the operation there were the same changes presented in the blood as in Case 2. The polychromatocytes became less marked, there are fewer nucleated red cells, less difference in the size of the cells, and there was the same fragmentation of the center of the larger cells. There were no megakaryoblasts, the nucleated cells being of the normoblast type.

The most marked difference in the two cases was the absence of the nucleated cells which were so conspicuous in Case 2. The significance of the presence or absence of these small cells is problematical, but from the favorable progress made by Case 3, it might seem to be a favorable symptom to have the small cells present, as it may indicate more beneficent attempt on the part of the blood making

apparatus to regenerate the blood than in the other case where the cells are apparently of the more mature type.

During the year 1913 an occasional article appeared in the German medical journals advocating removal of the spleen, not only in cases of Banti's disease, but also in cases of primary pernicious anemia, which had not before that time been considered fit subjects for surgical intervention. These reports have shown that splenectomy even in individuals who are desperately ill is entirely feasible and that an immediate and striking improvement results. This disease is one in which great fluctuations in the clinical condition and blood findings are prone to occur. The immediate results in the first few cases might have been explained in this way but when the published case reports show that all develop this immediate striking improvement, we must conclude that the operative work is responsible therefor. The only case reported in this country is one by Harpole and Fox.<sup>1</sup> The immediate results in that case and in the two cases reported in this article coincide with those reported in Europe. This work is too recent to hazard any opinion as to what the ultimate results will be. So far the case reports do not show that any patient suffering from this disease, upon whom a splenectomy has been performed, has returned to an entirely normal condition, either as to the blood findings or the physical findings. We are, however, justified in stating that—

First, splenectomy in primary pernicious anemia, even in those who are very ill, does not present any very unusual difficulties. The operation, unless a former splenitis has been present with resultant adhesions, does not cause much shock or inconvenience to the patient. There has been no operative mortality in the published cases.

Second, the improvement is immediate and striking, and a comfortable, temporary lease of life appears to be assured.

Third, in view of the variability of the conditions in cases suffering from this disease we are not warranted in promising a permanent cure.

Fourth, the immediate results are far more pronounced than in any palliative operation for cancer or other chronic conditions and if such an operation is ever justifiable, this operation certainly is indicated. This disease heretofore has been such a hopeless one to combat that any method that can be depended upon to give certain early improvement and which holds out a hope for permanent cure is worthy the serious consideration of all medical and surgical practitioners.

## A NEW METHOD OF CONTROLLING HÆMORRHAGE FOLLOWING SUPRAPUBIC PROSTATECTOMY

By FRANCIS R. HAGNER, M.D., F.A.C.S., WASHINGTON

Professor of Genito-Urinary Surgery, George Washington University, (Attending Genito-Urinary Surgeon, Garfield Memorial Hospital and  
Clinton Washington University Hospital)

ALTHOUGH some genito-urinary surgeons whose opinion I respect greatly consider that it is not necessary to use any means to control hæmorrhage after a suprapubic prostatectomy I know there are others who feel just as strongly that it is necessary to use something to control bleeding. We know these patients are old, and many are in such a debilitated condition that I cannot help but feel that our mortality records will be lower if we use some method to control this hæmorrhage.

It is not necessary that the patient should bleed to death for the hæmorrhage to be harmful. Old debilitated men losing blood over several hours thus lowering their resistance have a less chance to recover. Furthermore my own peace of mind is to be considered for if I have my pneumatic lag in the patient I am sure that he is not going to bleed.

Pneumatic pressure is not a new idea as it has been employed before. We know that for years an ordinary condom inflated with air was employed as a pressure agent to check nasal hæmorrhage. We have used various forms of packing in prostatectomy cases, and until the advent of this little pneumatic lag we had used an arrangement of gauze and catheter similar to that used by Dr. Lower of Cleveland.

*Disadvantages.* The troubles with gauze in controlling hæmorrhage are (1) that it does not always control it necessitating repacking (2) that pain is often caused in its removal and that secondary hæmorrhage may be produced by removal of the gauze although this is infrequent.

The little lag overcomes all these obstacles and is a great time saver. I believe it is more comfortable to the patient than the pressure of rawe packing.

We tried the lag first on March 3, 1904. We have used it on ten patients only one com-

plaining of the presence of the tube in the urethra this man had an exceptionally tender urethra.

You will see from the drawing that the tendency of this lag when in place is to accomplish what Dr. Lower of Cleveland and Dr. Walker of Baltimore have felt necessary, namely the pushing of the capsule upwards toward the urethra—not to fill up the cavity and push it back into the bladder.

The lag made of rubber is constructed so as to fold automatically when deflated (see cut). A rubber tube is attached to the open end of the lag. The other pole of the lag is attached a small rubber loop to which a string is tied to facilitate its removal through the suprapubic wound. We have also had made a lag with an inlet and outlet tube so that it may be distended with hot or cold water but the simpler lag controls the hæmorrhage so perfectly that we have found the more complicated lag unnecessary.

The following is the method of application. A specially constructed sound with beveled end (see cut) is inserted into the urethra and out through the suprapubic wound the tube attached to the lag is threaded over the beveled end and the sound withdrawn through urethra the tubing being pulled through and the lag pulled into place. It is then inflated. The lag is then distended by a 10 cc. Janet's syringe the pressure within the lag being readily discernible by the back pressure on the syringe. It is a little painful to insert the bladder through the suprapubic wound and sweep it round the lag with the hand but with the one or two urethra



and the public in Denmark are better instructed and more alive to the progress of medicine than Professor Schmiegelow can record 33 cases, when, with unique opportunities, Semon's full score was 24, and my own, so far is 17. If so a similar explanation would apply to South Germany, where Killian from the small provincial town of Freiburg was able to publish a larger number of foreign bodies extracted from the air-passages and gullet than any single laryngologist can do in the large cities of this empire. Now that the work initiated in London has been so successfully carried forward on the continent and in America and has been so handsomely appreciated by Professor Schmiegelow this evening let us hope that in England more patients will present themselves in time and that their medical advisers will recognize what can be done for them. Professor Schmiegelow's statistics agree with those of Semon in this country and of Chevalier Jackson in America, in showing that cancer of the larynx in the majority of cases is situated on the vocal cords. Hence, the most evident and constant symptom is a change in the voice. No individual should be boresome more than three weeks without at least securing an inspection of his larynx and a skilled opinion as to the condition of his vocal cords.

I am not sure whether in the ten minutes at my disposal I am expected to act as an *advocate* *et* attempt to dissect the excellent paper we have heard, but if so I have very little to say. I am in complete accord with Professor Schmiegelow in the employment of a general anesthetic, in doing a tracheotomy in removing the tracheotomy tube before the patient leaves the operating table, and in getting the patient out of bed as soon as possible.

His death rate from operation is somewhat heavier than that of Sir Felix Semon, or of myself. Semon had only one death from operation among 24 cases and that was evidently due to the administration of ether per rectum a dangerous proceeding which I regret to say there is some effort to revive. I have done laryngofissure 17 times for intrinsic cancer of the larynx without a single death. I understand that the deaths in Professor Schmiegelow's statistics occurred among his earlier cases when he used to employ plugging of the larynx.

Time does not permit of considering the technique in detail, but I cannot refrain from mentioning that I am well satisfied with the administration of chloroform by the mouth, the avoidance of Hahn's tampon cannula or any such contrivance with allowing the patient to sit up in bed as soon as ever he recovers consciousness, with freely open windows and the avoidance of steam-tents or similar emphysemas and finally with getting him out of bed and eating solid food within 24 to 48 hours.

As to recurrences, Schmiegelow records 11 in the 28 patients who survived the operation, or 40 per cent, Semon in 24 cases had 3 recurrences or 12 per cent. In 17 cases I have had two recurrences or about the same percentage, but if I take only the 13 cases who have passed the one-year limit established by Semon, my percentage of recurrences would be 15 per cent.

To conclude, I would here briefly record my own statistics.

Cases of intrinsic cancer of larynx treated by laryngofissure	1
Deaths from operation	1
Died from recurrence	
Recurrence, laryngofissure and ab	4 1/2 years later
No recurrence, including the last intracapsular case	1
Died from other causes 5 months, 3 years, 4 years, and 3 years after operation	4
Alive, 7 years after	
Alive, 1 1/2 years after	
Alive, 4 1/2 years after	
Alive, 2 1/2 years after	
Alive, 1 year after	
Alive, 1/2 years after	
Alive, 9 months after	
Alive, 8 months after	
Alive 9 weeks after	
Alive, 3 weeks after	

In no case did thyrotomy reveal any error of diagnosis although a preliminary microscopic examination of a removed portion was only available in six instances.

General anesthesia was used in all but one case.

One case died from separate and unconnected development of cancer in another part of the body.

Laryngofissure is not, in skilled hands, a dangerous operation. It shows far better results than the operations for cancer in any other part of the body and for intrinsic cancer of the larynx, treatment by laryngofissure is the only way.

## BOOK REVIEWS

### A CRITIQUE OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

By GEORGE GELLHORN M D SAINT LOUIS, MISSOURI

A MEDICAL work of almost eight hundred pages which within five years reappears in a third edition carries its own credentials. In the case of Bandler's Medical Gynecology it should be added that this book strikes a note which is fast becoming the dominant one in our newer conceptions of therapeutics. Gynecology has expanded beyond its original scope of merely treating the diseases and injuries of the pelvic organs as such. Modern gynecology takes a wider outlook and considers the normal and pathologic genital functions, their relation to the general physical and psychic health of woman. In carrying out, in detail, this principle of dealing with gynecologic diseases, Bandler's book represents the new science of pathologic physiology and must needs appeal strongly to the general practitioner as well as the gynecologic specialist.

Bandler's attitude becomes at once apparent by a glance at the headings of some of the chapters. He devotes 58 pages to discussion of the internal secretions and gives us, in a very concise form, an excellent expose of this important and interesting field which has just been opened to medical research and which bids fair to revolutionize many of our therapeutic methods.

The chapters on Amenorrhea and Dysmenorrhea are exceptionally clear and exhaustive and here as with all other subjects the effects of extra genital factors are lucidly set forth, and constant allusion is made to the etiologic and therapeutic importance of the glands of internal secretion.

The most frequent symptoms of gynecologic patients, leucorrhoea, uterine bleeding and pain, notably backache, are dealt with in separate chapters. For senile vaginitis Bandler recommends pyroglutamic acid, which in the review of experience, acts as a specific and deserves wider application in the hands of the practitioner.

The chapter on Associated Nervous Conditions in Gynecology deserves careful study. Nervous symptoms at puberty in chlorosis, during menstruation, and in pregnancy are discussed. Attention is called to masturbation as cause of nervous disturbances, and the relation of plexic and neurasthenic symptoms is fully considered. Cardiac phenomena associated with sex factors, hyperthyroidism, hy-

pophysis disease, and the climacterium as a source of nervous symptoms are given due consideration. Hysteria is a diagnosis made too frequently where there is in reality neurasthenia present and in this view most gynecologists and neurologists will concur. The diagnosis of reflex neurosis should be made with great care. Too often it cloaks ignorance of hasty conclusions. Rarely do pelvic abnormalities cause pain anywhere through "reflex" unless there exists hysterical predisposition. The author maintains that thorough examination will often show general conditions outside of the genital sphere or even the unfavorable influence of modern culture and social conditions responsible for many annoyances erroneously attributed to uterine malpositions, cervical lacerations, etc.

The chapter on Constipation, written by Dr. George Mannheimer, is characterized by the same wide outlook typical of the other sections of the book. The treatment of constipation must dispense with the pernicious drug habit. It consists of hygienic, dietetic and mechanical methods, and, where they can be ascertained, demands the removal of etiologic factors.

The remaining chapters take up the various diseases of the generative organs, and show in each instance how much can be accomplished by non-operative means. Thus by no means implies that there is sharp line between operative and medical gynecology. The delegate to the surgeon one part of gynecologic therapy (as is still the prevailing fashion) and to another man the non-operative part is obviously illogical and contrary to the best interests of the patient. Numerous conditions should be treated surgically only after a preliminary non-operative treatment and conversely many operations can benefit the patient only when supplemented by conservative means. Only thus shall we arrive at the true conception of gynecology as a specialty.

The chapter on Methods in Medical Treatment enumerates applications to urethra, bladder, vulvovaginal and urethral glands, vagina and uterine cavity. The oft repeated teaching that, in intra-uterine treatment, the cervix and especially the internal os must be wide enough to permit of thorough drainage is too often ignored. Bandler is an advocate of atelectasis and devotes considerable space to the discussion of this procedure without

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Died from recurrence			
Recurrence laryngofissure 2nd ab	4 1/2 years later		
1 recurrence including the last mentioned case			5
Died from other causes	3 months, 3 years, 4 years, and 7 years after operation		4
All	7 years after		
All	3 1/2 years after		1
All	4 1/2 years after		
All	3 years after		
All	years after		
All	1 1/2 years after		
All	9 months after		
All	8 months after		
All	6 weeks after		
All	5 weeks after		

In no case did thyrotomy reveal any error of diagnosis although a preliminary microscopic examination of a removed portion was only available in six instances.

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## THE RADICAL OPERATION FOR CANCER OF THE PYLORIC END OF THE STOMACH

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**P**YLORECTOMY and partial gastrectomy have been accepted operations for more than a quarter of a century.

Pean (1) in 1879 made the first pylorectomy; the operation was next performed by Rydygier (2) whose original contribution was both attractive and sound. The master surgeon Billroth (3) who did the first successful operation in 1881 must be given the credit for not only developing the technique but for a thorough elucidation of the principles which guide us in its performance.

Cunéo (4) by a brilliant study of the lymphatics of the stomach, added greatly to our knowledge of the spread of malignant disease of this organ and, based on his work, Mikulicz and Hartmann were able to point out the necessity for the extirpation of the glands on the lesser and greater curvatures respectively. In spite of the great importance of the contributions of these and other men in spite of the fact that the operation has been one of diminishing mortality and that undoubted cures are to be found in literature the operation has not been popular.

Cancer of the stomach is the most frequent form of cancer in the human body. In at least 75 per cent of gastric cancers the pyloric half of the stomach, which is the readily removable portion is involved. The opportunities therefore for the operative treatment of gastric cancer are many but the sur-

gical principles governing the operation are few and the results meager.

Probably the most important reason for this neglect of the stomach by the profession in regard to cancer of the stomach has been our inability to make a diagnosis sufficiently early for the performance of a radical operation with a reasonable operative mortality and a fair prospect of cure. At present, however, largely through radiography the clinical diagnosis of cancer of the stomach can be made in a large percentage of cases. Exploratory incisions which up to within the past few years were our chief reliance though carrying with them the patient's dread of an unnecessary operation, are fortunately no longer required in anything like the percentage of cases in which they were formerly necessary. The history of the patient, the roentgenographic and physical findings, and the use of the stomach tube to draw give a reasonable prospect of a correct early diagnosis.

The laboratory tests so long depended on and which had proved so fallacious a guide have been justly relegated to a minor position. These tests should not be abandoned, however. They are of value in differentiation and since they may now be checked up by other means their value should increase as we learn correctly to interpret their results.

Another reason for the reluctance with which the radical operation for cancer of the

however convincing as that this method with its complicated technique and numerous dangers could not well be replaced by other and simpler means. In reducing a retroflexed uterus he employs solely the manual method, but in our experience this will often fail, where Kuestner's method or the use of mercury colpeurynter will succeed. The treatment of vaginal discharges by means of drying powders is only briefly mentioned. This method, inaugurated by Nassemer of Munich, has so many advantages that it deserves more detailed discussion in the next edition. The same is true of the application of dry heat for the production of pelvic hyperemia, and the acetone treatment for inoperable cancer of the cervix. The latter, in particular efficacious as it is, recommends itself for general use because it is easily applied and quite painless and possesses undoubted advantages over the thermocoagulation advised by Bandler.

These and a few other technical points, in which one might differ from the author's suggestions, cannot detract from the value of the book as a whole. The principles enunciated in this volume are bound to meet with universal approval, and the gynecologist who makes these principles his own will not lay himself open to the satirical accusation that he looked upon the world in general and his patients in particular through a vaginal speculum.

GOETHE'S dying sigh *M hr Licht* seems particularly applicable to the field of sexual hygiene where utter darkness has reigned so long. We are all agreed that sex instruction is necessary and most of us are in agreement that such instruction comes best from the parents. But most parents have as yet distorted views on the subject themselves and are woefully ignorant on many points

or else they are still ashamed to speak to their children of that fundamental instinct to which they owe their own existence and the lives of their children—so that in this stage of transition, the physicians are the natural teachers for old and young and the best preachers of the gospel of Knowledge versus Ignorance.

There is no dearth of literary productions from the pens of medical men dealing with the sex problem, but many of the books offered will be found wanting on closer scrutiny. Some are too technical, others too sentimental, and there are also some that parade under the cloak of popular scientific communications which in reality should be classified as obscene literature.

It is, then, a pleasure to read, and recommend to others to read, two small volumes which have recently appeared in print. They represent in an amplified form series of lectures rendered by Dr. Steinhardt before a number of educational societies and other clubs. These "sex talks" are meant for girls 14 years and older and "boys 17 years and older" respectively but first of all they should be carefully read and reread by parents. The subject matter as given in these books, suggests itself the anatomy and physiology of the genital organs, the significance and hygiene of puberty, masturbation and coitus, moral and physical cleanliness, the effects of venereal diseases upon the present and the coming generations, et cetera. The subject point remains thus: how to say all these things and the author has solved his rather difficult task in a most successful fashion. He is simple and direct and he speaks with such sincerity that an atmosphere of confidence is at once created between him and his readers. Even if here and there some of the anatomical and physiological details are above the heads of the average lay reader yet the author drives his lesson home that the wage of ignorance is untold suffering. For warning is forewarned, is his motto. And these two little volumes are valuable factors in the mighty movement toward enlightenment of the masses.

THE SEX TALKS TO GIRLS (14 YEARS AND OLDER). By Irving David Steinhardt, M. D. Philadelphia and London: J. B. Lippincott Company 1914.

THE SEX TALKS TO BOYS (17 YEARS AND OLDER). By Irving David Steinhardt, M. D. Philadelphia and London: J. B. Lippincott Company 1914.



Fig. Blood vessels and glands separated crushing clamps in place and also helps to prevent leakage from part to be removed. Upper left drawing shows stump of duodenum in crushing clamp with suture placed for closing.

years made a number of the two stage operations for cancer of the stomach and of these not one patient died as a result of the resection. Standing alone this would seem to be a strong if not an absolute indication for the two stage operation. But an examination of the facts concerning these cases leaves the indications less clear since they were in a sense selected from a number of patients on whom we could have done a primary resection and who were subjected to a gastro-enterostomy with the intention of following this procedure by a resection but who for one reason or another never came to the radical operation. First some of those who were in a most serious condition died following the gastro-enterostomy. They would of course have died if a primary resection had been made instead of a gastro-enterostomy but the resection received the benefit so far as mortality statistics are concerned. Second some of the patient especially those with

large ulcerating cancerous masses, did not sufficiently improve after gastro-enterostomy to enable them to submit to a second operation again bettering the statistics of resection by the elimination. Third an occasional patient would improve so greatly following gastro-enterostomy that a radical operation would be refused until too late. Figure 1 shows a specimen from a considerable group of patients on whom we have done a primary partial gastrectomy but who for reason already stated would probably not have come to a secondary radical operation if a gastro-enterostomy had been done primarily instead of the resection.

Another fact of great importance was the occasional delay before the second operation as a result of various causes following the gastro-enterostomy — a delay which resulted in the vascularization of the adhesions which so often formed following the first operation and which in this process be-



Fig. 1. Uterus specimen. There is a lot of fat around it. Large (large) is the uterus.

as much has been a light but the procedure is the immediate most likely. These patients are usually of the risk the operation is one which requires a high grade of skill and technical knowledge, and the margin between recovery and death is at best a narrow one. The patient who does not know this will die because the condition which interferes with his recovery is in the most serious and the most not possible.

Little comment is necessary concerning the main features of the operation of hysterectomy. These are well known and are not in controversy. The lymphatic glands lying in four groups with the four iliac vessels are quite easily removed. The high ligation of the four vessels renders the field of operation dry and bloodless, an important consideration since loss of blood in debilitated

patient is the most potent cause of respiratory shock. The operation can be done in the average case within an hour.

There has recently appeared an encouraging number of contributions to this subject especially relating to the technique and on various suggestions for shortening the length of time of the operation which has been at least one of the factors in the death rate. Of these contributions, Crink (1) and Latham (2) are of the greatest value. The two-stage operation has been among the more important. They have rightly called attention to the fact that in febrile patients (patients with enterostomy) who are in a state of quickly improving the patient's nutrition and general condition and a resection can be made at a later time without serious risk.

In our clinic we have in the last fifteen

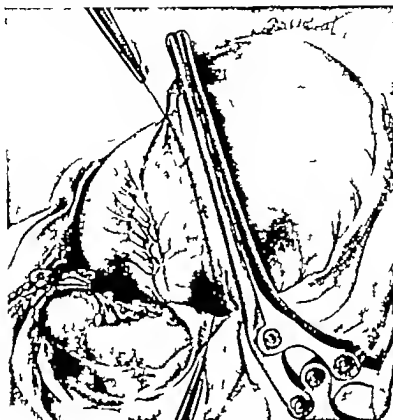


Fig. 4. Upper jejunum is to 1 cm. inches from oroca brought through an opening which has been made in the transverse mesocolon and united by outer row of seromuscular silk sutures to be posterior all of the stomach.

mortalities in some years following partial gastrectomies as low as 6 per cent in three years with an increasing experience and improved technique a mortality of twice that or even more due to the local cases which we accepted for operation and which would previously have been subjected if operated on at all to a palliative gastro-entrostomy.

Should patient with advanced cancer of the stomach be subjected to radical operation? In view of the fact that some of these patients especially those with large fungating growths have lived beyond the therapeutic limit we are compelled to answer the question in the affirmative. We should rather consider the fact that a patient subjected to the removal of the fungating growth in the stomach even if all the gland cannot be removed will get a year or more on the average of a very com-

fortable existence and that this comfortable existence is cheered by the knowledge that there is a possibility of cure since in some cases irremovable glandular hyperplasia is the result of infection rather than metastasis. These experiences acknowledged to be accompanied by a high mortality have led us to extend the radical operation to a group of cases which we would have formerly considered inoperable.

The most serious technical question concerns the form of reunion of the gastric stump to the intestine after the removal of extensive disease. The gastric stump is small it has already been seriously devitalized and the gastro-enterostomy will further devitalize the already damaged gastric wall. I am referring now to the Billroth method No. 2 that is complete closure of the duodenal and gastric



Fig. 1



Fig. 2

**Clinical manifestations.** The writer has studied the condition herein discussed in eight distinct patients, having observed it in the first patient June 28th 1910 and has found it present in varying degrees in a fairly large percentage of cases. The symptoms are *subjectively* sharp lancinating pain in the plantar region of the tarsus located at the astragalocalcaneal, or calcaneocuboid joint or both. It was fairly constant, was associated with pain in the posterior tibial muscle and occasionally slight pain in the anterior tibial and frequently pain and tenderness in the long flexor muscles of the toes. Occasionally sharp shooting pains were observed to be referred forward in the antitarsus generally more to the inner than to the outer side. The patient experienced

great fatigue after not long continued weight bearing the pain becoming intense and associated with progressive spasm. The pain and spasm subsided after prolonged rest, but on retiring would persist long into the night if not until morning, and it was observed that twenty-four hours or more was a period too short in which to gain relief. *Objectively* The posterior tibial muscle was tender to pressure its tendon was cordlike and sensitive to pressure and at its insertion tenderness was found. Pressure over the plantar tarsal ligament produced pain generally to a greater degree over the dorsal aspect of the medial tarsal joint. On manipulation a certain degree of rigidity of the tarsus



Fig. 3



Fig. 4



Fig. 5

Fig. 6

Fig. 7

was observed more in the direction of dorsal than plantar flexion and plantar flexion gave more pain in the tarsus than a force to obtain dorsal flexion would produce. An undue prominence of the head of the astragalus could be felt and only partially disappeared on dorsal flexion. Heel raising in weight bearing also caused pain in the tarsus. Forced voluntary dorsal and plantar flexion caused pain in the tarsus and the forced flexion occasionally would bring on spasm and severe pain in the tarsus. As a rule inflammatory manifestations were not present. Occasionally moderate swelling was observed dorsally and laterally at the juncture of the ankle-joint and tarsus. As a rule the arch



Fig. 6. Inner row of catgut through and through sutures applied to the posterior walls, uniting jejunum to cut end of the stomach and continuing part down the anterior wall.

case histories that the disease was very advanced in the patients who died. A number of operations (twelve) have been done recently in our clinic by this method with one death from pulmonary embolus, the autopsy showing perfect condition of the operative field. The technique employed is as follows: The diseased portion of the stomach removed in the usual way and the stump of the duodenum closed and buried (Fig. 2

and 3). An opening is made in the avascular arcade of the transverse mesocolon and the upper jejunum pulled through until it can be easily brought into contact with the stomach. The end of the stomach (Fig. 4) which is held in the crushing clamp of Payr, united by suture to the loop of jejunum (Fig. 4) quite as the ordinary gastroenterostomy is made. If the diameter of the end of the stomach be very large it can easily



Fig. 3. Clamping clamp on the stomach. Cautery used to sterilize and prevent carcinomatous implantation. Stump of duodenum closed. Sutures placed to turn the duodenal stump into the denuded head of the pancreas.

with carcinomatous cell. The question of the implantation of cancerous cells during operation is a most important one. I have related elsewhere (?) some cases in our early experience where cells were loosened up from gastric carcinoma and implanted upon the margins of the portion of stomach which remain following resection. For this reason we have since cauterized the cut end of the stomach and duodenum with the actual cautery to lessen this liability. In several of our cases the abdominal wound was so infected (rafting in carcinoma of the stomach) exceedingly common, especially grafting to the peritoneum and the necessary handling of the growth, irritation of the peritoneum and the injury inflicted by the performance of the gastroenterostomy itself are all matters of importance in this connection.

I am under the impression—after this true, a somewhat superficial examination of the

subject—that the percentage of five year cures in the two stage group has not been as high in our experience as in the one stage operation. It would seem that the two stage operation is one which should not be generally adopted, but rather one for the occasional case in which the general condition of the patient rather than the local condition of the tumor is the indication for this particular method. Under such circumstances we employ the two stage operation and believe that an occasional case is carried to a successful termination who might have been lost following the one stage operation.

If the two stage operation is decided upon, it is necessary to plan the gastroenterostomy opening so that it will be in a situation which will not clamp or hamper the resection.

The mortality depends more upon the cases which will be accepted for operation than upon any other one factor. We have had

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## LAVANDERA'S ANKLE

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WE are familiar with burns occurring in various and special burns according to the occupation or habits of various individuals in different walks of life and in different localities.

The inflammation of the bursa over the lower half of the patella popularly known as the housemaid's knee is probably the most common and universally observed. Other bursae which are not infrequently inflamed are the bursae over the tuber ischu and the bursa over the olecranon the former commonly being known as weavers' bot tom and the latter as miners' or students' elbow.

These three buratides result from chronic irritation applied to burae which exist as normal structures. Similar cavities known as abnormal or ad entitious burae are not infrequently developed in regions where exceptional pressure is applied upon some prominent structure. Histologically they consist of a fibrous wall the lining of which is a serous membrane and contain a small quantity of serum. These are formed by dilatation of lymphatic spaces and are the result of localized effusion into the tissues. Examples of ad entitious burae are met with in men of special occupation e.g. Covent Garden porters have burae over the scapula prominens (known as hummy) and Billingsgate

fish carriers have bursa under the center of the scalp

In Manila we find a bursitis (Fig. 3) which might appropriately be termed *lavandera's ankle*. Many of the washerwomen, or as they are popularly termed from the Spanish period *lavanderas* do their washing in the rivers and generally a flat rock which is close to the surface of the water and well down in the river is selected. The position assumed when working is such that the lateral aspect of the leg is next to the rock, the external malleolus thus coming forcibly in contact with the hard surface. The weight of the opposite leg rests upon the median aspect of



14. *Born substances, metalloids, laterals.*

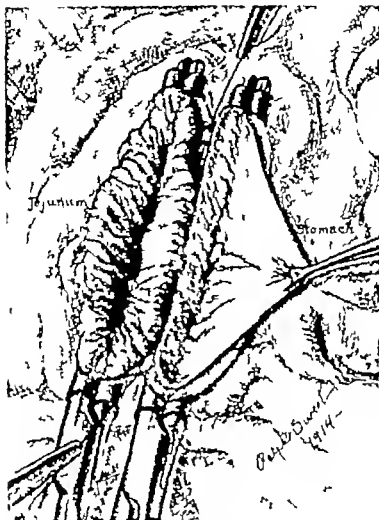


Fig. 3. Crushing clamp removed from the stomach and holding clamps applied to jejunum and stomach to prevent sliding.

stomps with an independent gastrojejunostomy which has become up to the present time, by virtue of its many advantages, the operation of choice by the majority of surgeons of the world.

The Billroth operation by method No. 1 that is, implantation of the duodenal stump into the narrowed end of the stomach is not applicable in these cases since the gap is too wide and the tension would be too great.

The operation of Kocher in which the end of the duodenum is implanted in the posterior

wall of the stomach for the same reasons is inapplicable although its distinguished originator advanced the field for his particular method by suitable mobilization of the duodenum.

It was with much interest, therefore that I investigated the method of Pólya (8) in which after the excision is made the end of the stomach is directly applied to the side of the jejunum about six to twelve inches from its origin. Pólya reported six operations with three deaths but will be noted from the

## THE OPERATIVE TREATMENT OF CARCINOMA OF THE PENIS

B. JOHN H. CUNNINGHAM, J. M. D. BOSTON

CARCINOMA of the penis is not common, but it is nevertheless one of the most important diseases with which the genito-urinary surgeon has to deal. Paget states that it comprises only 1 per cent of all cases of carcinoma. Billroth puts it at 3 per cent. In 33 years Barney found less than 100 cases at the Massachusetts General Hospital and at the Boston City Hospital I can find but 27 cases during the past 17 years. The small number of cases, however, makes it even more important, for as we all realize it is the rarity of a disease that leads to mistakes in diagnosis at a time when treatment might be successful.

Carcinoma of the penis, as elsewhere, invades the tissues and enters the lymph vessels, giving rise to metastases along the paths of absorption. It occasionally invades the blood vessels and causes secondary growths in various parts of the body and carcinoma originating on the penis has the same distressing outcome as characterizes carcinoma originating elsewhere in the body. It is with the idea of emphasizing the necessity of early diagnosis, the location of the metastases and the best manner of dealing with the condition by operative measures that this communication is made.

**Etiology.** This disease has a few special characteristics in causation worthy of mention. There is evidence which points to the belief that the disease may be carried from husband to wife and *vice versa*. Demarquay, MacFarland and Bruce each mention cases in which contact with the cancerous cervix seems to have been the etiological factor. It is interesting to note that Trauterson, Barney and others have shown the immunity of the Jew from this disease — which is suggestive at least that early circumcision may have some influence against the development of the condition. Writers upon this subject are inclined to regard phimosis an important factor in the causation of carcinoma of the penis and argue that phimosis causes a retention of

smegma and urine which they consider to be a predisposing factor.

Kaufmann in recording a series of 33 cases of carcinoma of the penis, states that he believes that 29 began as venereal warts. Demarquay in a series of 59 cases states that he believes the etiological factor to have been syphilis. Crippes, Martin and Sibley each have recorded a case of epithelioma developing upon the scar of a syphilitic ulcer and I too have had one case of this sort developing upon a syphilitic chancre which had been healed but a few months.

**Pathology.** In location, carcinoma of the penis is primary on the glans penis or the reflection of the mucous membrane from behind the corona to the prepuce and rarely in the fossa navicularis. The glandular portion of the penis is of ectodermic origin and the new-growth is therefore of the epidermic variety although Vander Veer has reported a case of mixed carcinoma and fibrosarcoma.

The growth is almost always papillary in form in the beginning and even when quite well advanced often suggests a benign papilloma or hyperplasia epithelial formation of inflammatory origin known as condyloma acuminatum which frequently forms on the glans penis. Infiltration or invasion of the tissue at the base of the growth is often very slight until the growth reaches a considerable size and this fact accounts in many instances for the failure to recognize the disease early as carcinoma. When the growth is of considerable size and cauliflower like in type with an ulcerated surface infiltrated at the base and with the presence of nodes in the inguinal region and in Scarpa's triangle the recognition of the true condition is simple but not so when the growth is small papillary in character with little or no infiltration at the base and when inguinal lymphatic nodes are not demonstrable. If all patients in the cancer age who present themselves with what appear to be venereal warts are given the consideration which they deserve a judicious



Fig. 7. Anastomosis completed by an anterior row of anastomotic silk sutures. Anastomosed end brought through the opening in the transverse mesocolon and margins of opening sutured to the stomach.

be diminished, by placing the sutures in such manner as to take a proportionately greater bite in the stomach than in the intestine thus reducing the lumen of the stomach as the suturing progresses. The stomach is anastomosed to the jejunum at a point where the jejunal blood-supply is extraordinarily good, and the jejunum can be depended upon to do more than its share in the healing process (Fig. 5). Before the inner through and through sutures are placed the stomach and intestine are grasped with elastic holding clamps to prevent soiling the inner row of sutures is then run entirely around and the outer row completed (Fig. 6). The entire anastomosed end of the stomach is then drawn

down below the transverse mesocolon and the margins of the opening in the transverse mesocolon carefully attached by a number of sutures to the wall of the stomach (Fig. 7). Fine silk is used for the peritoneomuscular sutures and chromic catgut for the through and through inner row.

This operation has some obvious advantages. It saves the time consumed in closing the end of the stomach and in cases in which only a small pouch of the stomach is left as very much easier than an independent gastroenterostomy. Unless further experience shows some contra indications, I predict for this procedure a large field of usefulness if it does not become the method of choice.

the external saphenous and femoral veins the others occupying the crural canal. These nodes are continuous in the pelvis with the internal chain of the external iliac nodes (Fig. 2). The deep group receives different vessels from some of the nodes of the superficial group and the lymphatics from the glans penis in the male and the clitoris in the female. It is important to keep in mind the deep group of inguinal glands as possible receptacles for metastasis in cancer of the penis for from this group the nodes of the pelvis may become involved.

The lymphatics of the urethra require mention. This system arises from a network of lymphatic vessels in the urethral mucous membrane from the meatus to the prostatic urethra. The point of practical importance is that some of these different lymphatics terminate in the deep group of inguinal nodes situated in the crural canal and others in the internal chain of the external iliac nodes continuous with them as seen in Fig. 2. Other afferent vessels pass over the lymphatics and terminate directly in the internal iliac nodes (Fig. 3). In other words the lymphatics of the urethra pass directly to the deep inguinal nodes and the nodes within the pelvis without any connection with the superficial inguinal nodes which is important to realize if the primary growth involves the urethra. I summarize briefly the lymphatics of the penis as follows: *first* those of the superficial ring of the penis draining into the superficial inguinal nodes which in turn connect with the deep inguinal nodes; *second* the lymphatics of the glans penis which drain into the deep inguinal nodes and in turn connect with the external iliac group in the pelvis; *third* the lymphatics of the urethra which drain into the superficial nodes with the lymphatics of the glans penis and not the system which passes over the lymphatics and directly into the nodes in the external iliac group.

I determine the frequency of the distribution of metastases to these lymphatic routes. I have examined the post-mortem of the Best in City Hospital and the Long Island Hospital in which records of the penis were preserved but none recorded with reference



Fig. 3. Lymphatics of the female pelvis and perineum showing the lymphatics of the urethra. (Cotton and McCall.)

formation which throws the directed light on this subject.

In regard to the location of metastases the clinical observation, however, have some significance. The cases operated upon at the City Hospital (primary operation) show the following:

There were 27 cases during the past 15 years. In 2 instances the clinical diagnosis was verified by histological diagnosis. In six cases the diagnosis was only clinical. In eighteen cases the metastases were noted as superficial or in the inguinal nodes. Four cases were superficial and deep on a involving the nodes of the group in two cases no metastases were present and in two cases no mention of metastases was made. In my own limited series of eight patients metastases were present at the primary operation in seven all bilateral. One developed a recurrence in the groin only the superficial nodes being removed at the primary operation. At which time one half of the penis was ampu-



Fig. 1. *Lavandera* at work.

the leg next the rock. And thus with the to-and fro scrubbing movement a considerable



Fig. 2. *Lavandera* ankle showing the characteristic sporadic appearance caused by hypertrophy of the subcutaneous bursa over the prominence of the lateral malleolus. Patient from the after service, Philippine General Hospital Manila.

pressure is applied over the prominence of the external malleolus.

Anatomically there exists normally a bursa between the integument and the prominent subcutaneous bony projection of the external malleolus. This is the bursa subcutanea malleoli lateralis (Fig. 1).

Histologically the walls of the bursa are found thickened, and the pathological process may well be classified as chronic fibroid or proliferative bursitis.

of the foot was increased and there was a moderate degree of varus. Although manipulative plantar flexion gave greater pain than dorsal flexion, severe pain was produced by attempted heel raising due apparently to enforced strain upon the posterior calf muscles.

The degree of mobility or luxation of the mediotarsal joint is by no means always commensurate with the symptoms present any more than is the degree of flattening or pronation of the feet proportionate to the symptoms manifested. There are so many factors entering into the symptom complex of talipes planus that it avails the physician but little who is content to prop up the



Fig 4

Fig 5

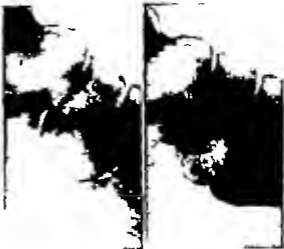


Fig 6

Fig 7

produce disability and are amenable to treatment.

*Radiographic study.* Radiographs made of patient suffering from mediotalar pain showed a more or less constant relationship in the joint structures, especially in the presence of rigidity, irrespective of the position in which the foot was placed. Figs 6, 7, 8 and 9 were made of the same subject with the feet placed in different positions, and, as illustrations show, the relationship is not materially altered. Figs 10, 11, 12 and 13 were made from patients who had tarsalgia and were taken with the foot placed at varying degrees of extension and plantar

arch and take chances on the results. A foot may show a movement from the normal in the relationship of all its joints and give trifling if any symptoms. Consequently it is not fair to assume that a subluxation of the mediotalar joint constitutes a pathological entity even when symptoms of relaxation are present but if the observations have been made accurately and if the deductions are correct—that painful contracture of the posterior tibial muscle and painful static subluxation of the mediotalar joint associated with other abnormal conditions herein named have a clinical and pathological reality, then it is fair to state that these conditions coexisting,

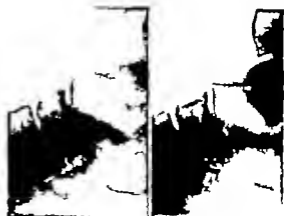


Fig 10

Fig 11

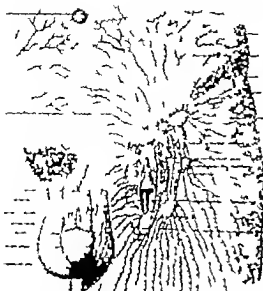


Fig. 1. (black) of the inguinal region affected and effluent lymphatics (Taken from Soper, 1916.)

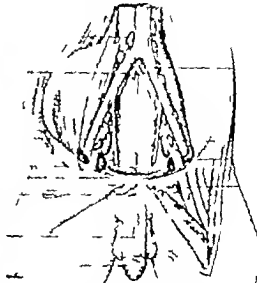


Fig. 2. Lymphatics of the gland in the new born infant (Crosby and Sherrill.)

of the histology of the growth will be made if the least suspicion in regard to its character is entertained. This is not putting any limitation on our clinical differentiation of a simple benign condition from a serious malignant one for the correlation of the clinical aspect with the histology is fundamentally correct in this, as in all other tumor growths, and the importance of recognizing any evidence of malignancy cannot be overestimated. Again let me refer to Kaufmann, who states that he believes that 29 out of 33 cases in his series of carcinoma of the penis started a venereal wart, and it is well established in the minds of pathologists that warts of this type do sometimes undergo malignant degeneration.

Early recognition of the true character of the growth as benign or malignant is most important to deal successfully with them for observations have established the fact that metastases are common and may occur early and beyond reach of surgical intervention.

**Metastasis.** To comprehend clearly the lymphatic distribution of carcinoma of the penis, a consideration of the lymphatic system of this region is important.

The lymphatics of the penis, scrotum

thigh and lower half of the abdomen all are part of the one system which drains into the nodes of the inguinal region and Scarpa's triangle (Fig. 1). These nodes have been classified by anatomy into a superficial group and a deep group with subdivisions, but from a clinical point of view the various subdivisions of this classification of the superficial and deep group are of little importance for all nodes of this region have no absolutely fixed relationship other than being superficial and deep, and all nodes of the superficial and deep groups may be invaded by metastases from the disease under consideration. From the clinical aspect, the division of the nodes of the inguinal region and of Scarpa's triangle into superficial and deep suffices. It is the involved superficial group of nodes that are commonly detected in the examination and removed at operation, and it is the deep group that usually not considered or sought for and removed with the result that when the deep groups harbor metastases and are left at operation it is in this region (Scarpa's triangle) that recurrences are most commonly observed. The deep inguinal nodes, usually three in number are situated internal to the femoral vein, the lowest at the point of union of

be described is to remove the penis, the fat carrying the lymphatics, and the lymph nodes all in one mass. This has been successfully done by the following procedure:

1 A condom is placed over the penis to prevent implantation of cancer cells during the operation.

2 A sweeping U shaped incision is made beginning slightly above and to the inner side of the anterior superior spine on one side downward in the fold of the groin to the root of the penis and upward on the other side. This incision passes just through the skin (Fig. 4) and outlines an apron, which is dissected upward.

3 An incision passing just through the skin is made downward over Scarpa's triangle from the center of Poupart's ligament. The skin is dissected inward and outward making two flaps (Fig. 4).

4 Beginning at the top of the abdominal incision the fat which contains lymphatic channels is dissected in one mass from the abdominal fascia. This dissection is carried downward into Scarpa's triangle on either side. The superficial nodes are removed till imbedded in the fat if possible. Hemorrhage during the abdominal portion of the dissection is light but as the dissection is carried over Poupart's ligament into Scarpa's triangle the superficial epigastric, the superficial iliohypogastric and the superficial external pudic vessels must be secured beneath the fat mass as they come through the fascia. If the nodal element is marked the growth may extend into one mass through the fascia lata into the deep inguinal nodes in which at the first is divided. The artery is drawn outward if necessary and the incised node freed from the femoral vessel. Poupart's ligament may be divided to continue the dissection into the crural canal. If the mass is not continuous from the superficial to the deep node the fascia lata is divided and the leg node freed from the femoral vein and node.

5 The patient is then placed on the lithotomy position. An incision is begun at the root of the penis passing around the testis uniting beneath and continuing beneath the raphe of the scrotum bisecting it. The urethra is divided and the dorsal

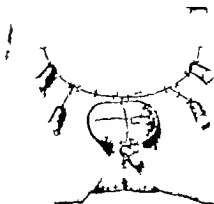


Fig. 4. Shows the course of the drainage. The urethra is held in the perineum. The scrotal cord is partially freed in the line of incision and partially by constricting the incision into lateral cords.

vessels of the penis secured. The penis with the attached fat mass from the abdomen and groins is drawn downward. The dissection is carried on until the attachment of the crus to the pubic ramus is met. These are clamped close to the bone and cut away. The stump is transfixed and tied and no hemorrhage results (Fig. 5). It is necessary to clamp, transect and tie for the arteries to the crus may otherwise retract and cause troublesome hemorrhage. Then the corpus spongiosum is freed at a distance of about three-fourths of an inch in front of the bulb and cut across at this point unless the membranous urethra seems sufficiently long. It is better to leave too much than too little urethra. The whole mass of the abdominal and inguinal fat containing lymphatics and nodes, the penis and the crura are then removed in one mass.

6 The cut end of the urethra is then stretched to the lower part of the perineal incision and a self-retaining catheter placed through the urethra into the bladder. A drain is placed in the perineum also in the wound of the abdominal skin apron on either side and in the incision in both Scarpa's triangles (Fig. 6).

The manner of suturing the scrotum where it is lifted upward so that it will not become a skin is very important.

**Operative result.** The literature in regard to this point is unsatisfactory. Barnes' contribution is the only one which gives satisfactory

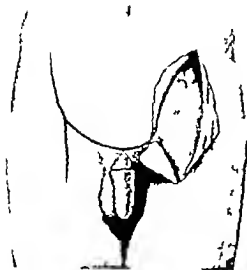


Fig. 4 Shows penis involved in cancerous focus of carcinoma. Abdominal and inguinal lymph nodes partially freed.

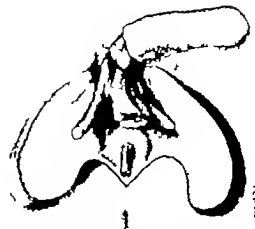


Fig. 5 Shows the anatomy dissected. The dorsal is reflected. The crural artery freed from the pubic ramus and their anastomosis freed. The membranous urethra separated from the scrotum and the abdominal fat mass above.

tated. The remaining case, an amputation of the distal third of the penis, refused to have the groins dissected and there was no evidence of recurrence in the groin 6 months following operation. Nothing further is known about this patient. It is seen therefore that of eight cases seven had metastases and the other may have had it at a date later than 6 months.

Barney, in a series of 66 cases, in which the glandular condition was noted, states that 75 per cent showed metastases present, that the involvement was mostly bilateral and that in many instances the metastases occurred early in the disease. He also notes that 15 per cent were in vital organs. Kaufmann, in a series of 48 cases, found that 40 had carcinomatous metastases in the inguinal nodes, and that 30 of the 40 were bilateral. Kuettner, in a series of 60 cases, states that the inguinal nodes were involved in 70 per cent, although only 32 per cent were proved to be cancerous.

Barney, in a series of 100 cases, operated upon by various methods, found 26 cases in which recurrences of the disease took place. That recurrences are common is evident from the literature on this subject. It is also evident that the inguinal nodes are invaded not

only by carcinoma from the primary growth, but also by a secondary inflammatory process, which is so often present and that gland suppuration often results.

**Operation.** As has been pointed out, the primary growth usually involves the distal portion of the penis and metastases take place along the lymphatic channels of the penis to the superficial inguinal nodes, then to the deep inguinal nodes and then under Poupart's ligament to the iliac nodes within the pelvis. If the urethra has been involved by the growth, metastases may take place through the lymphatic channel, passing over the symphysis directly to the pelvic nodes. As has been noted also, the lymphatic channels of the lower half of the abdomen drain into the superficial inguinal nodes. It is necessary therefore to remove these channels in great part in order to prevent a lymph block, when all the lymphatic nodes of the inguinal region are removed. The operative procedure is therefore twofold: First, to remove the growth and the lymphatic channels through which metastases take place and second, to destroy the secondary lymph channels which also drain into these nodes. The aim of the operative procedure about to

got about again, but evidence of metastasis in the abdominal organs, especially the liver appeared within three months and he died May 1913 five months following the last operation.

The chief points of interest in this case are first the development of carcinoma upon the site of a syphilitic chancre and second the recurrence of the carcinoma in the group of deep nodes which were left at the first operation because they were not palpable. It is also

interesting to note that there was little change in the circulation of the leg following the resection of the femoral vein.

In conclusion it would seem that we are not dealing with carcinoma of the penis as radically as we should and that recurrences from metastasis in the lymphatic nodes not sought for and removed at the primary operation can be overcome by more radical measures than are commonly employed.

## TWO CASES OF FILARIASIS

### WITH AUTOPSY FINDINGS

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CASES showing the results of infection by filariae are rarely seen in hospitals in the north temperate zone. Within a short time of each other two such cases were treated in the wards of the Royal Victoria Hospital, Montreal. In each case after an acute febrile illness, death occurred and a post-mortem examination was permitted. It was thought that a short report of the clinical condition along with an abstract of the autopsy findings might be of interest.

**CASE.** Female colored, 4 years old was admitted to the medical and to the hospital August 9. She complained of itching each groin which had been present for two years. She said that after washing the swelling could feel little sore. This was her only complaint. Aside from this she claimed to be in perfect health. Up to a few months ago she lived in a tugboat British West Indies. Two years ago she had a little of febrile disease which she called malaria. She did on and off for nearly one year. Her father had suffered from filariasis.

She was well nourished, bright, healthy looking, dark skinned girl. Mucous membranes good color, no dyspnoea, no cyanosis. Very intelligent. The inguinal glands were considerably enlarged and were more prominent when the patient assumed the erect posture. They were the size of hen eggs, had bumpy ancone feel, were reducible

and no impulse on coughing and were dull on percussion.

Leucocytes. 1000 red cells, 4,600,000 haemoglobin 60 per cent. A differential count gave the following: Polymorphonuclear leucocytes 70 per cent, large mononuclear leucocytes, 1 per cent, eosinophiles 3 per cent, small lymphocytes 18 per cent. Filariae in the characteristic of filaria bancrofti were found in the blood.

The patient was transferred to the surgical ward. The enlarged lymph glands were removed on each side. Adult filariae were not found. The excision was prompt. As long as the patient remained in the hospital the injury could be found in the blood at night. She left the hospital feeling quite well, and happy to be rid of the filariae the groins.

She was readmitted on June 1, 1913, eight months after the removal of the lymph glands. The groins. She complained of sore throat and difficulty in swallowing, pain in the joint, slight headache and general malaise. Her temperature 101° pulse 96 respiration 24. The glands on the right side of the neck were palpable and a little enlarged. During the next seven days there was little or not. The temperature gradually dropped to normal on the fifth day and remained so for 48 hours. On the eighth day it rose to 100.3. She vomited quite frequently. Urine and specific gravity 1.020 albumin present no sugar no cast. On the tenth day her temperature was 101° and on the following day it was 100°. She was somewhat delirious. Her leucocyte count on this day 3,000, and pure culture of streptococci was obtained from the

blood. She died on the 15th day after admission to the hospital. For 24 hours before she died she was in a semi-unconscious condition. There never had been any rash.

**Abstract of post mortem report Case 1.** The body was that of a colored girl measuring 45 cm. length and of good physique and build. The lips were blue. The teeth were well formed and in good condition. The pupils were equal and the conjunctive clear. The lymphatic glands were palpable. The heart was well formed, the coronary gland small. Abdomen flat. The hair of the head was abundant, straight and black. There were brown pigment spots on the face and scars on the thighs from the removal of regional glands and scars on the inside of the left leg. The solvent nerves 1.5 cm in thickness.

The heart weighed 65 gms and measured 9.0 cm in transverse diameter. Blood was found in the pericardial sac. The macroscopic appearance of the heart sections indicated acute myocardial degeneration.

**Respiratory system.** The trachea was pale, the bronchi and bronchioles were normally congested. There were minute focal hemorrhages in the pleura, especially at the bases of the lungs. The lungs were indurated and rich blood. The histological sections showed acute congestion.

**Digestive system.** With the exception of slight edema of the walls of the large intestine and patches of the mucosa of the stomach, no abnormality was found in the gastrointestinal tract.

**Liver.** The liver reached 4 cm below the costal border in the right nipple line. It weighed 100 gms and measured 9.5 x 5 cm. It was firm and its surface was smooth. It was friable, brown, swelling was marked. Sections showed passive congestion and fatty degeneration.

**Pancreas.** Soft and pink in color, the lobules loose in texture. The connective tissue was congested.

**Urogenital system.** The kidneys showed active congestion and cloudy swelling. The uterus was 7 cm in length and 3 cm in breadth. It presented no abnormalities. The ovaries were normal. The fallopian tubes on section showed the presence of general fibrous adhesions existed between the folds. The epithelium was well preserved and many cilia were detached. The centers of the villous processes were strongly rich fibrous tissue a condition which suggested previous acute changes. The blood vessels were everywhere congested. The uterine wall was fibrotic, the muscular coat thin. There was no inflammatory cellular infiltration.

**Spleen.** The spleen weighed 7 gms and measured 9.5 x 14 x 4.5 cm. The surface was finely granular. The capsule was tense. The malpighian bodies were small and many showed hyaline change. The pulp tissue was congested. The edges of malpighian bodies were anastomosing cords. The cords were indistinguishable.

**Adrenals.** The cortex of the adrenals was pale and the different zone not good. The pigment was pale and the medulla gray.

**Lymphatic glands.** The striking lesion in this case was the wormlike enlargement of the lymphatics as if as they could be traced from the inguinal canal to the thoracic duct. The channels had purple color and were extremely tortuous especially about the fallopian tubes and in many of the pockets of the peritoneal cavity. Where lymphatic nodes were ordinarily situated their contours were lost in dense plexuses of lymphatic channels. When cut into, they revealed a blood stained erythroid fluid. These channels were conspicuous on account of their dusky color. They followed especially along the sides of the aorta. They could be traced into the hilum of the spleen, around the adrenals, and up into the thorax along the side of the aorta. Sections of the lymph nodes presented varying appearances. Some presented necrotic foci others showed almost complete absence of lymph tissue and replacement by dense infiltration of polymorphonuclear and blood cells. Others, again revealed sections of cut lymphatic leucocytes and a watery fibrous tissue as observed with focal hemorrhages here and there. There was distinct loss of differentiation in the majority of the sections, with absence of lymph follicles, indistinguishable pulp cords and indistinct blood channels. Numerous small hemorrhages in the gland substance and a diffuse overgrowth of fine fibrous connective tissue were features of interest. A dense polymorphonuclear leucocytosis was observed in other sections. Although leukocytosis was made for adult filaric none was found in the tissues. Some sections suggested beginning calcification yet microscopic examination was not confirmatory.

The most marked feature in many of the sections was the extensive fibrous tissue changes in places occluding what are once patent lymphatic channels.

**CASE VI.** Age 13. A young girl quite as dark of complexion as the first. On admission she complained of painful swelling on the left groin, constipation, nausea and vomiting. Her temperature was 38.5. She was debilitated and soon passed into a state of semi-unconsciousness. She had been ill only three days. Her first symptoms were chills, vomiting, slight headache and general malaise. These symptoms persisted and were followed by marked prostration. The bowels did not move and vomiting followed the taking of food. She complained bitterly of pain in the left groin. The swelling in the groin increased size and the nausea and vomiting became very distressing.

She was born in British Guiana and had been in Canada only three months. No history of scarlet fever or other diseases of childhood had never had pneumonia or pleurisy. The swelling in the groin had been present for 1 year. There had never



along with the inflammatory cell exudate the marked fibrosis, and the pressure from lymph, may be considered a factor adding in the production of the varices. Experimentally occlusion of the thoracic ducts does not always produce a varicose condition of the lymphatics.

The association of fibrosis with filarial infection is well shown in cases of elephantiasis, where the fibrous tissue extension is marked in the cutaneous and subcutaneous areas. The patent channel of the varices in our cases were not occupied by lymph but by blood and blood stained lymph. Possibly the rupture of small blood vessel into portion of the varices may explain this finding.

The origin of the terminal infection in each case was impossible to place with precision. It may have started about dead ault parasites. The fibrosis and destruction of the lymphatic system consequent upon the filarial invasion so evident in microscopic examination of the tissues in our cases was so great that even an ordinary infection might have resulted fatally in patients deprived of those bulwarks of defense.

Bahr describes six cases of what he terms filarial fever in which sudden onset high temperature, leucocytosis, convulsions and microfilariae in the blood were the leading features of interest. The sudden onset temperature and leucocytosis are common to many infections they might in cases of filariasis be attributed to a streptococcus or staphylococcus infection about dead ault filariae and the condition might be termed filarial fever in the sense that it occurred in patient suffering from filariasis.

Eosinophilia is a feature of great interest in filarial infection. They have been found even more numerous when the peripheral circulation swarmed with microfilariae. Three species of filariae are fairly well recognized as human parasites. Of the three *S. bancrofti* has received the most attention in the literature. The adult *S. bancrofti* measures about 38 mm. in length is filiform in shape and resembles an animated gray hair. It possesses a globular head and its mouth is unarmed. The male is smaller and less numerous than the female and is found

as a rule in the lymphatic channels and gland of the body. In the uterus of the female eggs may be found in various developmental stages. When mature they are discharged into the lymph stream after a time reach the right side of the heart and eventually find their way into the peripheral circulation. These microfilariae are filiform in shape and measure about 300  $\mu$  in length and from 7 to 8  $\mu$  in breadth. They are in length about 30 times the size of a red blood corpuscle. Each individual embryo is enclosed in a membrane. The number found in the blood varies greatly at different times during the day and night. The marked characteristic of *S. bancrofti* is its appearance in the peripheral circulation at night. Thus from 5 P. M. until midnight they are found in large number. From midnight till daylight they gradually decrease and during the day only an occasional one may be found. During the day they retire to the lungs and the large thoracic vessel. The reason of this periodicity on the part of the microfilariae *bancrofti* is not known. It is presumed that the sleeping time of the patient has something to do with it while others think it is connected with the feeding habits of the intermediary mosquito host. Bahr contends that the non periodicity of the *Sierrae* and *Samoan* filariae is explained by the day feeding habits of the mosquito. Manson has found as many as 500 red microfilariae on a single microscopic slide and it has been estimated that from forty to fifty millions circulate in the average adult infected individual. Many are killed in the tissues, supposedly by the endothelial cell and by the blood ferments. In order to attain maturity the microfilariae must be taken into the body of certain mosquitoes found in filarial districts. Without proper protection in tropical climates and with microfilariae swarming the peripheral circulation at night it is not difficult to understand how this is accomplished. Ingested along with some blood into the mosquito stomach, the microfilariae loses its vitelline membrane and shortly afterward hatches its way through the stomach wall. In the thoracic muscles of its host it attains a size of 2.5 mm. and when further developmental processes have taken place

place it reaches the salivary organs. When the mosquito bites (man for instance) it is discharged into the wound reaches the circulatory system, lodges in the lymphatic glands or channels, and in the course of time attains adult dimensions. The number of adult filariae that may be found in the tissues is considerable, but it is by no means as large as the number of microfilariae. In filarial districts the majority of the inhabitants on examination of the blood, reveal the presence of microfilariae, but show no marked symptoms or signs of the infection. Only a small percentage show the results of the invasion. In one or more of the following conditions: lymphangitis, varicose inguinal glands, lymph scrotum, hydrocele, chylocele, chylous pleurisy and peritonitis, chylous urine, abscess formation, elephantiasis. The adult filariae may be found in the lymphatic gland and vessels. In these situations they may die, and the site of their death is often the starting point of a local or generalized infection. Sometimes they calcify after death, but, alive or calcified they produce fibrosis of lymphatic tissues and blocking and destruction of lymphatic gland and channel. Eosinophils are present in large number around living or calcified filariae.

Destruction of lymphatic tissue and ensuing fibrosis as a result of filarial infection has been frequently pointed out. One of the theories advanced explaining the causation of elephantiasis from filarial infection is based on the fact that in these areas there is frequent blocking of intra abdominal lymphatic. This blocking may be due to the filaria themselves, to endothelial proliferation in filarial irritation, or to circumscribed fibrosis.

Failure at autopsy to find adult filariae in cases known to have been infected has been noted by other observers. Bahr has published a report on filariasis and elephantiasis found post mortem examination of cases known to have had filariasis. But dying of other causes than the varicosities of the abdominal and thoracic lymphatics but not in every case were the adult filariae discovered. He also describes an autopsy on a case of filarial fever which revealed in addition to calcified filariae and extreme

lymphatic varicosities great fibrosis and destruction of lymphatic tissue. Four cases of septic infection following filarial invasion were noted with recovery in each case. But of eight cases of abscess formation, in one only were adult filariae found in the excised and drained tissues. He is of the opinion that surgical treatment is of little avail as a curative measure for filariasis. Benefit to the patient undoubtedly results from incising and draining the broken down glands, due primarily to filarial, and secondarily to streptococcal and staphylococcal infection. But for a cure to follow the accidental discovery and removal of adult filariae from incised tissues is not always probable or possible. It might happen that the patient was harboring only the adult organisms discovered at operation, but as a rule other adult filariae are present in the deep lymphatics of the trunk.

Cunningham has reported a case of filariasis in which at operation inguinal varicosities were found to extend into the abdomen. He found no adult filariae in the excised masses and no evidence of their presence on microscopic section of the tissue. Limrose considered that the cure of a case of filariasis in which filarial lymph scrotum was present and operated on by him was due to the finding of the adult worm in the tissue removed at the time of operation. He advanced in support of his contention the absence of microfilariae in the blood sixty seven days after operation. He refers to the experience of Matland and others who obtained similar results from the same procedure. Manson was of the opinion that the cure occurring in Limrose's case followed an attack of lymphangitis of the neck forty six days after the scrotal operation which led to the removal of a sloughy mass in the neck. The occurrence of lymphangitis (so common in filarial cases) may have indicated the presence of dead adult worm in the neck lymphatics unrecognizable when removed in a sloughy mass.

Bahr relates an interesting case of disappearance of microfilariae from the blood in some respects similar to the cases in which filariae seemed to be cured by surgical intervention. The patient had microfilariae

up to an attack of filarial orchitis along with adenitis of the groin. After this they could not be found. Pure cultures of *trichosax* were recovered from the pus in the groin. He relates a number of cases where the microfilars disappeared from the blood and states that in every such case some inflammatory disturbance preceded the disappearance. No explanation is offered for this result. A clinician would be inclined to attribute the disappearance of the parasites to some

therapeutic measure which he had employed, and not to an inflammatory process which was mainly a coincident one.

#### DIPILOM MATRIS

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## SURGICAL MYXORRHEA COLI, MYXORRHEA MEMBRANACEA AND MYXORRHEA COLICA

(MUCOSA OF INTESTINE AND COLICA MUCOSA)

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IT is difficult to define membranous colitis and mucous colic because they are not a disease but a symptom complex characterized by copious, pericolic mucous discharges, abdominal discomfort or cramps and constipation (pastic) characteristically which vary greatly in different cases and under varying circumstances, and finally because the same patient may at one time seek relief from mucous colic or at another from excessive mucomembranous excretion. Myxorrhoea coli occurs more frequently in women and asthenic individuals than in men but is exceedingly rare in the very old and in the young.

The nomenclature of these conditions is confusing, and authorities of reputation have coined more than twenty expressions and at their interpretation of mucous colitis and membranous colitis various membranous colitis (Da Costa), colico mucosa (Schlagel), tubular diarrhoea (Mason), pseudomembranous enteritis (Cruveilhier and Laboulbène), myxoneurotic coli (Wakli), myxorrhoea nervosa coli (Albu), mucous ticosa (Whitehead), intestinal neurosis (Siedlitz), mucous enteritis, mucous colitis and distal pseudomembranous.

Owing to the fact that mucus responsible for these conditions is secreted or collects within the colon to eliminate the confusion which exists concerning the nomenclature of so-called membranous enteritis and colica mucosa the writer suggests that the caption

myxorrhoea coli be applied to all mucous stools, myxorrhoea membranacea to excretion characterized by strings, strips, or bowlike membranous mucous casts and myxorrhoea distalis to mucoid collections within the colon. Then by adding the prefix myxorrhoea to the factor responsible for the hypersecretion or retention of mucus, myxorrhoea coli could be classified as follows: Myxorrhoea atarrhalis, myxorrhoea constipativa (or obstipativa), myxorrhoea pastiva (or respensiva), myxorrhoea traumatica, myxorrhoea infectiosa, myxorrhoea dyspeptica, myxorrhoea toxica, myxorrhoea obstruativa, myxorrhoea nervosa, myxorrhoea benigna, myxorrhoea paraneurica.

La Jégou, formerly author attributed myxorrhoea toxica and myxorrhoea membranacea to neuroses which led to the hypersecretion of mucus. Later Schlagel claimed the two might be caused by neuroses or intestinal atarrhia. Recent investigations have

shown that these manifestations may also be induced experimentally and by a variety of conditions.

Clinicians agree that nervous phenomena viz hysteria, neurasthenia, melancholia and trophoneurosis, are frequently observed in persons who suffer from myxorrhoea colica and myxorrhoea membranacea, and they are willing to concede that organic or functional nervous affections or psychic disturbances may induce or aggravate them.

The chief claims in favor of the neurotic origin of myxorrhoea membranacea and myxorrhoea colica are based upon the nervousness of such patients and the normal appearance of the mucosa which frequently obtains during life and at autopsy. Many reasons can be advanced to prove that mucous colic and membranous colitis are frequently produced in other ways as follows:

1. Few patients afflicted with insanity, hysteria, melancholia, or other nervous affections suffer from myxorrhoea coli.

2. Mucous discharges may occur independently or complicate nervous diseases.

3. Myxorrhoea colica and myxorrhoea membranacea may obtain for years without the patient becoming nervous.

4. Frequently neurogenic disturbances do not appear until months or years after the onset of myxorrhoea coli.

5. Correction of associated neurogenic disturbances often fail while therapeutic measures directed against local or general disease causing intestinal irritation succeed.

6. The frequency of myxorrhoea membranacea and colica in women and the fact that they are usually encountered between the twentieth and forty-fifth years indicate that abnormal menstruation some time influences the hyper-secretion of mucus.

7. Atonic or spastic constipation usually precede and accompany mucous stool and are probably a factor in their causation since they frequently cease when regular evacuation are established.

8. Copious discharges of membranous or jelly-like mucus with and without colic follow frequent or prolonged administration of copper sulphate, mercury, tannic acid, glycerine and iodine colonic irrigation.

9. It has been demonstrated experimentally that the secretion of mucus can be augmented by iodine silver nitrate or alcohol application to the intestinal mucosa, reflex action through other organs or the solar plexus and by injecting rabbits with sodium oxalate, subjecting them to infection, having them eat indigestible food and stimulating the intestinal nerves with electrical currents.

10. Patients suffering from myxorrhoea coli usually have previously suffered from gastrointestinal or systemic disturbances.

11. Owing to the similarity of mucous discharges in intestinal catarrh and mucomembranous colitis it is often impossible to dissociate them.

12. Mucus may be constant in colitis but when mucous stools appear periodically colic ensues and the mucoid discharges are membranous, it indicates that myxorrhoea colica or myxorrhoea membranacea are secondary to intestinal catarrh.

13. Mucomembranous evacuations and colic have followed fermentation and putrefaction and very likely are caused by excessively active colon bacilli or other intestinal microorganisms and their toxins.

14. Myxorrhoea membranacea and myxorrhoea colica are occasionally associated with intestinal helminths which irritate the mucosa.

15. Intestinal stasis and auto-intoxication frequently complicate myxorrhoea membranacea and myxorrhoea colica and probably cause them in some cases.

16. Myxorrhoea colica and myxorrhoea membranacea are occasionally a manifestation of foreign bodies (intestinal sand, enteroliths, bismuth accumulations and scybala) which traumatize the intestine.

17. Colonic coprostein is accompanied by nerve phenomena and mucous evacuations which disappear when it has been corrected.

18. The expulsion of jelly-like or inspissated mucus is not characteristic of particular affection but is a reactionary phenomenon occurring under varying conditions. Tremblere says that mucous stool do not represent a peptic factor more than does mucous sputum a peptic disease of the respiratory tract.

19 Mucous colic and membranous colitis may be secondary to defective metabolism in phlegmatic or nervous individuals

20 It has been demonstrated by bowel inspection that myxorrhoea colica and myxorrhoea membranacea may be induced by organic changes in the mucosa

21 Finally it is sometimes difficult to determine whether myxorrhoea coli is dependent upon affections of the nervous system disturbance inflamed mucosa or obstructing lesions, because one or all may be factors in the same case and produce the symptom-complex of myxorrhoea coli

The writer has treated patients for myxorrhoea coli where multiple and widely varying factors played a part in its production hence he is constantly on the lookout for more than one cause

Myxorrhoea coli not infrequently complicates atrophy and atony of the large intestine and has suddenly appeared during and following diphtheria scarlet fever measles promaline poisoning influenza typhoid fever chemical poisoning and disturbances of the liver gall bladder pancreas, and kidneys

Gastrogenic disturbances (achyl gastritis, hyperchloridia and cancer) which unbalance the secretion, lead to its stagnation or interfere with gastric motility occasionally lead to mucromembranous colitis and myxorrhoea coli has accompanied enterogenic disturbances which modify the succus entericus

Frequently myxorrhoea colica and myxorrhoea membranacea are symptoms of catarrhal, syphilitic, tubercular balantidic entamebic, coccidic flagellat bacillary helminthic, and other types of colitis

Myxorrhoea coli may also be induced by scybalæ, purgation irritating drugs, enterocolitis massage, vibratory treatments or any thing which irritates or inflames the mucosa or causes constipation, intestinal obstruction enterospasm, or fecal retention and it has been known to follow the rough handling of the intestine, abdominal viscera and pelvic organs during operation and curetæ introduction of the sigmoidoscope

Individuals afflicted with myxorrhoea membranacea and myxorrhoea colica have a lowered vitality are under weight, act slowly and

frequently suffer from anomalies of the teeth, nails or hair movable kidneys enteroptosis, uterine procidentia, hæmorrhoids, varicose veins, hernia, insufficiency of the tissues (connective nervous, and muscular) and nutritional trophic disturbances of the lymphoid and mucous glandular mechanism (adenoidism)

Rhinopharyngeal lesions (vegetations, etc.) and intestinal disorders compose the symptom-complex of adenoidism observed in thyroid disease, which is an important factor in myxorrhoea membranacea and myxorrhoea colica. Tremblère holds that atrophy and hypertrophy of the thyroid gland are frequently associated with myxorrhoea coli, and when it is not so associated, the liver kidney or some other organ is involved and causes faulty metabolism, malnutrition, or trophic changes and myxorrhoea membranacea or myxorrhoea colica

Myxorrhoea membranacea and myxorrhoea colica may be aggravated or caused by any of the following surgical diseases or conditions viz congenital deformities of the bowel, foreign bodies relaxed abdominal walls, movable cecum, splanchnoptosis, malignant and non malignant neoplasms, peritonitis, appendicitis, salpingitis, diverticulitis, pericolic, adhesions, tumefactions, invagination (intussusception) volvulus extra intestinal pressure, stricture, angulation, Lane's kink abdominal aneurism, rectocele diseased or displaced neighboring organs, mesenteric disturbances, hernia cholelithiasis enterospasm, obstruction by intestinal parasites, procidentia recti, hypertrophy of O'Berne's sphincter the rectal alvea, levator ani and sphincter muscles, deviated coccyx and rectal affections (hæmorrhoids ulcers or fissures)

The above diseases, singly or collectively lead to the hypersecretion of mucus because they narrow block, or immobilize the intestine interrupt peristalsis induce constipation and fecal impaction, augment pathogenic bacteria and their toxins, induce inflammatory and ulcerative lesions in the bowel irritate the mucosa stimulate the secretory and motor nerves to excessive activity fa or intestinal auto-intoxication, or retain feces

and discharges until they become offensive and irritating.

Constipation may be congenital or may appear early in life and nearly always is a complication of mucous colic and membranous colitis hence the author believes these conditions are often caused by mechanical intestinal defects which lead to fecal retention. Under such circumstances, owing to the small amount of food ingested by infants and young children, no trouble ensues in the beginning but later when the diet is liberal and the feces are more bulky they pass the obstruction with difficulty and stagnation takes place and a hypersecretion of mucus ensues.

The writer has observed myxorrhoea coli in a boy of three in a girl of five and in six other children under twelve years of age who suffered from post-operative sequelae where attempts had been made to correct congenital deformities of the colon, rectum or anus.

In studying the etiology of myxorrhoea coli one should keep in mind the relation of the colon to the diaphragm, kidney, liver, stomach, uterus, adnexa, bladder and prostate, because the bowel is often displaced by neighboring organs or becomes involved through the extension of disease from them.

Splanchnoptosis (enteroptosis, coloptosis, nephroptosis, hepatoptosis, and gastropptosis) is frequently associated with and evidently causes myxorrhoea colica and myxorrhoea membranacea, because stools and colic usually disappear when the organs have been replaced and anchored.

Appendicitis, peritonitis, pericolicitis, diverticulitis, abdominal and pelvic suppurations, typhoid fever and colitis frequently lead to myxorrhoea coli because they favor the formation of exudates, bandular, broad, or encircling adhesions or pseudoperitoneal membranes which agglutinate or bind the gut to neighboring organs or the paretics twist, angulate or press upon it causing colonic irritability, fecal retention and hypersecretion of mucus.

Three times the author has cured myxorrhoea coli by removing bismuth accumulations from the colon or rectum and many times he has arrested mucoid evacuations by clearing the gut of scybala and fruit stones, seeds, or skins.

The writer has a record of two hundred patients operated upon for constipation induced by chronic invagination of the sigmoid flexure into the rectum of whom 25 per cent suffered from myxorrhoea colica or myxorrhoea membranacea, and the majority of these sufferers were speedily relieved or cured by sigmoidoscopy. The frequency with which women suffer from mucomembranous colitis and the good results which follow the extirpation of uterine tumors, diseased tubes and ovaries and the correction of uterine displacements, demonstrates that female genital disturbances may cause myxorrhoea coli.

Vesical and prostatic diseases may also augment the secretion of mucus in some instances by traumatizing the gut or exciting the levator ani muscle to frequent contraction.

In 75 per cent of the cases of myxorrhoea coli treated by the writer the hypersecretion of mucus was apparently caused by adhesions, angulations, invagination or mechanical bowel defects, inflammatory or ulcerative lesions of the colon or rectum which increased the mucus or caused its retention until it became inspissated and membranous.

In concluding his remarks upon the etiology of myxorrhoea membranacea and myxorrhoea colica the writer would reiterate that the hypersecretion of mucus is a common manifestation complicating many chronic medical and surgical diseases of the bowel and that the amount, consistency and form of the mucoid evacuations depend largely upon the irritable state of the intestine, enterospasm, shape of the gut where the mucus accumulates, and length of time it is retained.

If internists and gastroenterologists are aware of these facts they fail to mention them consequently their followers believe that myxorrhoea colica and myxorrhoea membranacea are always induced by intestinal catarrh or neuroses, when they may be caused by many other diseases and conditions.

The pathology of myxorrhoea coli is not understood because it is not characterized by definite lesions, seldom kills and has been studied at autopsy only a few times where it complicated other fatal diseases. The author has observed myxorrhoea membranacea and myxorrhoea colica in patients where the

flexion. In these cases there is a fairly constant relationship of the joint structures. Figs. 14 and 15 were made of the writer's foot and illustrate the movement which takes place in the mediotalar joint when there is no spasm of the muscles controlling that joint. Figs. 16 and 17 also demonstrate the slight amount of motion that may take place in an abnormally flexible foot from the position of right angles to extension with plantar flexion.

*Treatment.* The writer has used with a varying degree of success the following treatment. In severe cases prolonged rest from weight-bearing in a plaster of Paris cast, followed by exercises, massage, etc. to tone up the weakened muscles. During the treatment, methods to improve the patient's general condition were employed, after which a shoe to hold the foot in a proper position in weight bearing was prescribed, which was designed especially to prevent tarsal torsion. In mild cases, such measures as massage, sedative local applications, adapted exercises, and the proper shoe were used, with temporary regulation of the mode of life which was the exciting factor of the malady.

In all cases, if there exists a constitutional predisposing cause general treatment must

be employed and good hygiene should be instituted and maintained. As an operative measure, from the condition observed it seems fair to assume that a tendoplasty of the posterior tibial tendon when it is contracted, or an arthrodesis of the calcaneocuboid or astragaloscaphoid joints, or both would be a rational procedure, provided that the correction of static errors has not proved to be efficient.

#### CONCLUSIONS

1. That such a condition is of static origin, generally combined with a systemic disturbance.

2. That the condition of static subluxation of the mediotalar joint has for its principle factor a contraction and shortening of the posterior tibial muscle, and generally is associated with a depression of tone and power of the anterior tibial.

3. That a fairly constant type of symptom can be found.

4. That it usually exists without a frank inflammatory process present.

5. That the condition will yield to prolonged rest or palliative measures, or both.

6. That a certain derangement of relationship of structures in the foot and leg and perversion of function, will produce a definite type of pain in the tarsus, or tarsalgia.

seek relief from either myxorrhoea membranacea (mucous casts) or myxorrhoea colica (colic). During acute attacks curative measures should be held in abeyance for the patient desires immediate relief from the discharge of mucous casts or masses or colic from which he suffers. When the patient seeks a cure the writer informs him that myxorrhoea coli is a manifestation of some other affection and that after the crisis is passed, prolonged treatment or an operation may be required to effect a cure.

Where tenacious mucus collects in the lower sigmoid or rectum it can be removed with a blunt scoop or swab and cotton following the introduction of the sigmoidoscope but when higher up rest in bed a liberal dose of castor oil, hot water drinking, abdominal fomentations, and hot high colonic enemata are indicated to soothe the mucosa and cause the intestinal musculature to relax, which in turn overcomes constipation favors expulsion of the mucus, and relieves the patient mentally and physically.

Strychnia gr 1/60 (0.001) Fowler's solution M 5 (0.30) extract of physostigma gr 1/4 (0.15) hypophosphites Russell's emulsion and other nerve muscular or general tonics are indicated when the sufferer is nervous or run down and the treatment is more effective when supported by hydrotherapy abdominal massage vibration or electricity when the bowel is sluggish.

Where the bowel is sensitive and highly irritable and enterospasm is a complication belladonna M 10 (0.60) relieves the muscular spasm, but when colic is severe it should be reinforced by codein gr 3/4 (0.03) or morphia gr 3/4 (0.016) administered every three or four hours to arrest pain and induce sleep.

Between attacks of myxorrhoea membranacea and myxorrhoea colica, liquid paraffin or abolin administered in the morning and at night in liberal doses, lubricates the intestine minimizes constipation and favors the expulsion of mucus before it becomes inspissated and irritating.

It is advisable in some cases to control the diet, but a routine dietary is impracticable because of the variegated etiology of myxorrhoea coli. During attacks of myxorrhoea

colica, better and quicker results are obtained when the patient eats more frequently and consumes chiefly hot fluids milk, soup, purées and meat juices, and abstains from foods which leave a large residue.

Following an acute attack of myxorrhoea membranacea forced feeding and a diet composed mainly of vegetables (cellulose) in conjunction with rest in bed after the plan of von Noorden usually corrects constipation, which is followed by cessation of the mucomembranous evacuations and in uncomplicated cases the myxorrhoea does not occur while the patient has normal movements.

A heavy coarse diet temporarily causes sensations of abdominal fullness and discomfort but they disappear spontaneously. Where constipation ensues from overdigestion the administration of regulin pieces of cork, or seeds increases the bulk of the faeces, stimulates peristalsis, and usually brings about normal evacuations.

As soon as myxorrhoea coli and constipation have been relieved the patient should return to his regular diet and discontinue the regulin. A cellulose or vegetable diet is out of place where the hypersecretion of mucus is augmented or caused by gastrogenic, enterogenic, or neurogenic disturbances or colitis, because it makes the faeces bulky and irritating to the hypersensitive, inflamed or ulcerated mucosa, augments the secretion of mucus, and has a tendency toward enterospasm and colic.

Drastic cathartics are contra-indicated during crises of mucous colic because they cannot drive faeces through the blocked gut but increase the patient's suffering. Purgatives also do more harm than good where myxorrhoea membranacea or colica are complicated by chronic intestinal obstruction from whatever cause since they stimulate violent peristalsis and do not secure the coveted evacuation. Under such circumstances, comfortable stools can be obtained by hot water drinking and the administration of mineral oil salts in small repeated doses, fluid extract of cascara sagrada M 15 (1.0 cc m) or a mild dinner pill to soften the excreta, or belladonna M 10 (0.60) to soothe and relax the irritable intestinal musculature.

Astringents (tanalbin tannigen ichtho-

19. Mucous colic and membranous colitis may be secondary to defective metabolism in phlegmatic or nervous individuals.

20. It has been demonstrated by bowel inspection that myxorrhoea colica and myxorrhoea membranacea may be induced by organic changes in the mucosa.

21. Finally it is sometimes difficult to determine whether myxorrhoea coli is dependent upon affections of the nerves, systemic disturbance, inflamed mucosa, or obstructing lesions, because one or all may be factors in the same case and produce the symptom-complex of myxorrhoea coli.

The writer has treated patients for myxorrhoea coli where multiple and widely varying factors played a part in its production, hence he is constantly on the lookout for more than one cause.

Myxorrhoea coli not infrequently complicates atrophy and atony of the large intestine and has suddenly appeared during and following diphtheria, scarlet fever, measles, ptomaine poisoning, influenza, typhoid fever, chemical poisoning, and disturbances of the liver, gall bladder, pancreas, and kidneys.

Gastrogenic disturbances (achylgastrica, hyperchloridia, and cancer) which unbalance the secretion, lead to its stagnation, or interfere with gastric motility, occasionally lead to mucomembranous colitis and myxorrhoea coli has accompanied enterogenic disturbances which modify the succus entericus.

Frequently myxorrhoea colica and myxorrhoea membranacea are symptoms of catarrhal, syphilitic, tubercular, balantidic, entamebic, coccidic, flagellate, bacillary, helminthic, and other types of colitis.

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Myxorrhoea membranacea and myxorrhoea colica may be aggravated or caused by any of the following surgical diseases or conditions: viz. congenital deformities of the bowel, foreign bodies, relaxed abdominal walls, movable cecum, splanchnoptosis, malignant and non-malignant neoplasms, peritonitis, appendicitis, salpingitis, diverticulitis, pericolic adhesions, tumefactions, invagination (intussusception), volvulus, extra-intestinal pressure, stricture, angulation, Lane's kink, abdominal aneurism, rectocele, diseased or displaced neighboring organs, mesenteric disturbances, hernia, cholelithiasis, enterospasm, obstruction by intestinal parasites, procidentia recti, hypertrophy of O'Beirne's sphincter, the rectal valves, levator ani and sphincter muscles, deviated coccyx and rectal affections (hemorrhoids, ulcers or fissures).

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mucosa was inflamed or ulcerated and where it appeared normal. Most often, however, it has been encountered in individuals who had been suffering from intestinal stasis, fecal impaction and toxæmia induced by mechanical defects in the colon or rectum which caused fecal retention.

**Symptoms.** Under normal conditions the amount of mucus secreted is so slight that it is difficult to discover in the feces with the microscope, and when visible in the stools it is being abnormally secreted and the patient suffers from myxorrhœa. The manifestations of myxorrhœa coli are variable in different cases and in the same individual at different times, but obstinate constipation and the periodic evacuation of large quantities of mucus and colic constitute the chief symptoms.

When hypersecretion is marked and mucus is long retained, the water is absorbed and it becomes inspissated, grayish in color and accumulates in a large mass or when compressed, it assumes the form of bowel casts or strips acts as an irritant, and excites mild peristalsis which favors its expulsion.

Myxorrhœa colica and myxorrhœa membranacea may dominate the disease producing them, and clear jelly like mucous evacuations may prevail for weeks or months, when suddenly a crisis sets in, the patient complains of cramps, and later of the evacuation of mucomembranous trips or casts. Again he may suffer indefinitely from mucous discharges induced by a variety of causes and never complain of myxorrhœa colica or myxorrhœa membranacea.

Persons afflicted with myxorrhœa membranacea and myxorrhœa colica are sometimes bothered with impaired digestion, *maelaise*, melancholia, nervousness, and abdominal uneasiness, discomfort, soreness, pain or colic for a short while before mucous stools appear or remain well in the intervals between attacks of myxorrhœa coli.

Strips or casts of mucus occasionally create crawling sensations and are mistaken for worms, but when low down they are easily located through the sigmoidoscope and are to be seen projecting through the rectosigmoidal aperture or hanging over the rectal alve. When mucus becomes dry and collects in any

form, it causes irritation and leads to enterospasm (*myxorrhœa colica*) marked constipation, fecal impaction, gas distention, and colic, which continue until it is evacuated through the sigmoidoscope or in some other way.

Diarrhœa may be noticeable during attacks of myxorrhœa colica or it may not occur until the obstruction incident to enterospasm has been relieved and the backed up irritating feces, scybala discharge and toxins find their way into the lower bowel and excite abnormal peristalsis and the hypersecretion of mucus.

**Diagnosis.** Usually in obstinate cases of myxorrhœa coli the history will show that the patient has been troubled for weeks, months, or years with gastro-intestinal disturbances, menstrual abnormalities, constipation, psychic or nervous phenomena, disturbances of the liver, pancreas, or heart, or obstructing lesions of the gut prior to the attack, which indicate that the mucous discharges are secondary.

Myxorrhœa coli is diagnosed with ease by the mucoid evacuations (made up of jelly like or mucous strings, strips, or casts) which appear suddenly following attacks of nausea, indigestion, obstinate constipation and abdominal uneasiness, discomfort or soreness in patients who have otherwise been compared to *rely well*.

Myxorrhœa colica must be differentiated from other types of intestinal obstruction but, in the presence of the enumerated symptoms, violent colic, and the absence of pus or blood in the stools, one is justified in diagnosing this condition before and after the mucous collections have been evacuated. When an acute attack of myxorrhœa coli subsides, the abdomen and intestine should be examined and the feces analyzed with the object of ascertaining what is causing the hypersecretion and retention of the mucus. It is also important to determine whether or not the sufferer is afflicted with a nervous or other affection which would influence the myxorrhœa colica or myxorrhœa membranacea.

**Treatment.** A routine treatment of myxorrhœa coli is impracticable owing to its varied etiology and because the patient may

## UTERINE SARCOMA

By WILLIAM D FULLERTON PH B M D CLEVELAND OHIO

Recent Resident Gynecologist Lakeside Hospital

WHILE primary sarcoma of the female genitalia is not common, it is, however not infrequently met with, and this applies particularly to sarcoma found in the ovaries. Sarcoma of the vulva is very rare (1) usually melanotic in type and, as elsewhere metastasizes early. In the vagina, sarcoma is less common than primary carcinoma which is rare in this location. Its presence here has been noted congenitally and in women up to eighty two years of age. However 75 per cent of the cases occur in children under fifteen years and in these cases the growth is of a dull red or chocolate brown color circumscribed and polypoid in form. In adults it occurs as a diffuse infiltration or as a rounded sessile growth prone to ulcerate.

In this paper we are particularly concerned with primary sarcoma of the uterus. In 1860, C. Mayer first described uterine sarcoma, stating that the growth was a sarcomatous polyp. This was confirmed by Vircchow. In 1867 G. Veit first described sarcoma of the cervix.

Anatomically uterine sarcomata may be divided into those originating in the cervix or the fundus. Histologically those occurring in the fundus arise either from endometrium, from the uterine wall, or from a myoma. In both uterine wall and myoma the process may start either in the fibrous connective tissue or in the muscle tissue. When originating in a myoma they have been designated by Williams (2) as myosarcoma and myoma sarcomatodes depending upon whether they originate in the connective tissue or in the muscle respectively. In these cases, however both muscle and connective tissue are usually ultimately involved. In the cervix they originate either in the connective tissue in muscle, or in a fibroid as in the fundus.

Sarcomata of the uterus, as elsewhere in the body are divided into large and small, round or spindle-cell anetives although the

types frequently more or less overlap. The sarcomata of blood and lymph vessels the perithelial angiosarcomata which arise from connective tissue and the endothelioma of these vessels which are cytologically a cross between carcinoma and sarcoma, are finer histological differentiations which we will not separately discuss. Melanotic sarcomata are never primary in the uterus though secondary growths have been reported.

Two-thirds of the number of women with uterine sarcoma are below the average in child-bearing have not reached puberty or have not borne children for a long time. According to Montgomery (3) Weir (4) Williams (5) and others, sarcoma of the body is more common than sarcoma of the cervix, though Fisher holds the opposite opinion.

Sarcoma of the cervix occurs, usually either before twenty or after the menopause. There are three fairly defined types. First, the grapelike cystic, or racemose variety first described by Spiegelberg in 1879 consisting of masses of nodules or vesicles projecting from the cervix. These nodules are oval or rounded in shape, one to two centimeters in length, and translucent or bluish and hemorrhagic in appearance resembling closely the substance of a hydatid mole. They contain a thick, sticky clear or turbid fluid. Microscopically these cysts are covered by a single layer of cylindrical epithelium within, they consist of larger rounded or spindle-cells separated by clear spaces which are traversed by fine fibrous threads. With this type the progress is slow they are reluctant to invade and only occasionally or at a late stage do they invade the muscularis which usually shows a reduced vascularity.

The second type, the solid polypoid or nodular sarcomatous tumors of the cervix, are soft, yellowish, or pink in color the surface is smooth and glistening in the absence of necrosis, which is rather late to occur.

There remains a third type, the diffuse

form, and bismuth subgallate gr  $\frac{1}{2}$  (560) may be called for in the treatment of myxorrhoea coli complicating colitis when diarrhoea is troublesome but should be discontinued when the stools become normal.

When myxorrhoea membranacea is associated with inflammatory ulcerative or obstructive lesions of the colon, the patients can be quickly improved by treating the mucosa with medicated solutions or oil introduced through the anus or through an appendicostomy or cecostomy opening which insures their reaching all parts of the bowel.

Long colon tubes are not dependable for irrigating purposes because they double up in the sigmoid flexure or rectum and prevent the solution or oil from passing into the bowel, causing pain. Medicaments can be made to reach the upper colon by placing the patient in the exaggerated knee chest posture introducing the sigmoidoscope and pouring the irrigant or oil directly into the bowel with the aid of a pitcher and funnel attached to rubber tubing or by inverting the patient and employing the author's funnel shaped proctoscope and pitcher which enable one to pour a quart or more of solution or oil directly into the colon on account of the inflation and displacement of the viscera which ensues.

The author has experimented with many irrigants in myxorrhoea coli alone or complicated by ulceration and diarrhoea, but obtained the best results from boric acid 3 per cent, ichthyol balsam of Peru and potassium permanganate 1 to 2 per cent, and argyrol 5 per cent irrigations, employed daily or three

times weekly. When the mucosa is sensitive and the musculature highly irritable, warm crude oil containing bismuth should be substituted for or alternated with irrigation because of its soothing and healing action. *Surgical Treatment.* When the intestine is obstructed by adhesions, a kink, twist, pericolic membrane, extra bowel pressure or stricture, etc. the lesion must be corrected before a permanent cure can be obtained.

In cases where the colon is permanently disabled, *resection* may be necessary but when the patient is in poor condition and cannot withstand a prolonged operation the diseased bowel should be isolated by *entero anastomosis* or by *unilateral or bilateral excision*.

*Cecostomy* has been successfully employed in the treatment of myxorrhoea coli but has been abandoned in favor in appendicostomy, cecostomy, resection or intestinal exclusion because of its disgusting features and the serious secondary operation required to close the artificial anus.

The *prognosis* of myxorrhoea membranacea and myxorrhoea colica is very good when caused by obstructing lesions of the colon correctable by operation, but a longer time is required to effect a cure when they are secondary to inflammatory or ulcerative lesions of the mucosa and myxorrhoea membranacea and myxorrhoea colica are more difficult to eliminate permanently when the hypersecretion of mucus is induced by gastrogenic, enterogenic, or neurogenic disturbances general disease or atonic constipation.

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Two thirds of the number of women with uterine sarcoma are below the average in child bearing have not reached puberty or have not borne children for a long time. According to Montgomery (3) Weir (4) Williams (5) and others, sarcoma of the body is more common than sarcoma of the cervix though Fisher holds the opposite opinion.

Sarcoma of the cervix occurs, usually either before twenty or after the menopause. There are three fairly defined types. First the grapelike cystic, or racemose variety first described by Spiegelberg in 1879 consisting of masses of nodules or vesicles projecting from the cervix. These nodules are oval or rounded in shape one to two centimeters in length and translucent or bluish and hemorrhagic in appearance resembling closely the substance of a hydatid mole. They contain a thick, sticky clear or turbid fluid. Microscopically these cysts are covered by a single layer of cylindrical epithelium within they consist of larger rounded or spindle cells separated by clear spaces which are traversed by fine fibrous threads. With this type the progress is slow, they are reluctant to invade and only occasionally or at a late stage do they invade the muscularis which usually shows a reduced vascularity.

The second type, the solid polypoid or nodular sarcomatous tumors of the cervix are soft yellowish or pink in color, the surface is smooth and glistening in the absence of necrosis which is rather late to occur.

There remains a third type the diffuse in

form and bismuth subgallate gr.  $\lambda$ . (66j) may be called for in the treatment of myxorrhoea coli complicating colitis when diarrhoea is troublesome, but should be discontinued when the stools become normal.

When myxorrhoea membranacea is associated with inflammatory ulcerative or obstructive lesions of the colon, the patients can be quickly improved by treating the mucosa with medicated solutions or oil introduced through the anus or through an appendicostomy or caecostomy opening, which insures their reaching all parts of the bowel.

Long colon tubes are not dependable for irrigating purposes because they double up in the sigmoid flexure or rectum and prevent the solution or oil from passing into the bowel, causing pain. Medicaments can be made to reach the upper colon by placing the patient in the exaggerated knee-chest posture introducing the sigmoidoscope and pouring the irrigant or oil directly into the bowel with the aid of a pitcher and funnel attached to rubber tubing or by inverting the patient and employing the author's funnel shaped proctoscope and pitcher which enable one to pour a quart or more of solution or oil directly into the colon on account of the inflation and displacement of the viscera which ensues.

The author has experimented with many irrigants in myxorrhoea coli alone or complicated by ulceration and diarrhoea but obtained the best results from boric acid 3 per cent, ichthvol balsam of Peru and potassium permanganate 1 to 2 per cent, and argyrol 5 per cent irrigations, employed daily or three

times weekly. When the mucosa is sensitive and the musculature highly irritable, warm crude oil containing bismuth should be substituted for or alternated with irrigation because of its soothing and healing action. *Surgical Treatment.* When the intestine is obstructed by adhesions, a kink, twist, pericolic membrane, extra bowel pressure or stricture, etc. the lesion must be corrected before a permanent cure can be obtained.

In cases where the colon is permanently disabled *resection* may be necessary but when the patient is in poor condition and cannot withstand a prolonged operation, the diseased bowel should be isolated by *entero-anastomosis* or by *unilateral or bilateral excision*.

*Colestomy* has been successfully employed in the treatment of myxorrhoea coli, but has been abandoned in favor of appendicostomy caecostomy resection, or intestinal excision because of its disgusting features and the serious secondary operation required to close the artificial anus.

The *prognosis* of myxorrhoea membranacea and myxorrhoea colica is very good when caused by obstructing lesions of the colon correctable by operation but a longer time is required to effect a cure when they are secondary to inflammatory or ulcerative lesions of the mucosa and myxorrhoea membranacea and myxorrhoea colica are more difficult to eliminate permanently when the hypersecretion of mucus is induced by gastrogenic, enterogenic, or neurogenic disturbances, general disease, or atonic constipation.

A DISCUSSION OF POTT'S FRACTURE WITH COMPLICATIONS BASED  
ON A SERIES OF 208 CASES

By KILLOGG SPEED M. D. Chicago

AS a basis for study of this fracture I have taken the cases of fracture discharged from the Cook County hospital during the year October 1912 to October 1913 comprising 1316 cases. As the histories are filed merely under the heading "fracture," it was necessary to go over this entire number of history sheets and it was found that in this period there were 208 cases diagnosed as Pott's fracture fracture of both bones at the ankle fracture of either one or the other malleolus or both malleoli but all called Pott's fracture at one point or other on the history sheet in the examining room or in the wards both before and after skiagram was made. To establish the findings in these 208 cases so grouped together by this name equaling 15 per cent of all the fractures discharged from the institution it was necessary in addition to obtain from the histories information regarding the taking of skiagrams and what knowledge of the case was obtained from the pictures. It was found that in only 24 cases no skiagram had been taken for the most part because the patient had left the hospital before thirty-six hours stay or had refused treatment and in 95 per cent of the cases where skiagram is recorded as having been taken little or no notation of the findings discovered by it are recorded and even when recorded little definite information results. For instance two cases of Dupuytren fracture are noted a few of both malleoli and many of typical Pott etc while in a very small number definite information as to exact point of fracture and bone or bones involved is given and in one glorious exception it is recorded that the astragali is dislocated outwards some what.

The men making these records doubtless knew at the time exactly the type and extent of lesion in each case but for one reviewing this work a dry subject and perhaps a trifle one at it best it be some necessary to review

also these skiagrams after digging out their serial number from the depths of each history and then obtaining them from the hospital files. Covering these 208 cases of fracture I have been able to find and inspect 161 skiagrams.

The idea back of this investigation is to attempt to standardize and particularize these fractures about the ankle to establish a habit of exactness in nomenclature and to narrow down these common breaks to exact description such as could be conveyed in few words. Incidentally it seems that the last word will always remain to be spoken on fractures. The more one sees and reads of them the more one realizes how much can be learned from them and it is possible that better and more efficient treatment can be accomplished by such studies as these. If one stops to consider it is quite difficult to define exactly what a Pott's fracture is. I have asked many surgeons this question recently and get many different answers.

The definition given by Pott in his book in 1769 is that of a fracture of the fibula three or four inches above the external malleolus with a tearing of the internal lateral ligament.

On looking over these skiagrams I have been struck by the relatively few typical Pott and the looseness toward the tip of the malleolus of the site of fracture in a majority of the cases and have classified them as follows noting carefully in each case where the external malleolus was fractured whether the skiagram also showed a separation from the bony surface of the internal malleolus or by position of the astragali that the internal lateral ligament had been ruptured. Such cases treated by a Dupuytren plant with the foot in marked adduction later being placed in a cast in this position should give good results and I have tried to note the result where the X-ray photographs were also taken after the foot had been set paying par-

filtrative form which macroscopically is impossible and microscopically often is difficult to differentiate from carcinoma.

Sarcomata of the endometrium, the most common type of uterine sarcoma, constituting about one third of all cases, occurs relatively early in life and more frequently in nullipara when compared with carcinoma. Here they occur in diffuse or rounded lobulated forms, more frequently the latter. The edges are sharply demarcated and without encapsulation. The surface is smooth and glistening unless ulcerated which is not an early finding. The substance is soft often brainlike yellow white or pinkish in color and is early covered with intact epithelium. As a rule the glands are destroyed, but they may be either normal or hypertrophied, and they have been found to be the seat of a coexisting carcinoma. When cut into the tissue presents a smooth homogeneous, glistening appearance rarely traversed by broad trabeculae as in adenocarcinoma. The uterine wall usually is not invaded early and thus makes this type one of the most favorable for treatment.

Sarcomata of the wall occur either in the myometrium (mural) or more often in a fibroid, and in either case they are rarely if ever seen in the young. Mural sarcoma form single or multiple nodules arising in size rarely a diffuse infiltration. They tend to work toward the uterine cavity and form polyps. They may remain latent for a considerable period and they metastasize more slowly than a carcinoma but more rapidly than cervical sarcoma, the points of predilection being lungs, liver and intestines.

A great deal has been written concerning the occurrence of sarcomatous changes in fibroids, and the opinions vary considerably. Winter and Ruge (6) found sarcomatous changes in 2 per cent of subserous in 4.5 per cent of interstitial and in 9 per cent of submucous fibroids. Noble claims that 2 per cent of all fibroids show malignant changes. Klem, in 49 operations for myomata found that 2.6 per cent showed sarcoma and 5 per cent were accompanied by carcinoma. 3.2 per cent of the fundus and 1.8 per cent of the cervix. Mackenrodt (7) found carcinoma in

6 per cent of his fibroid uteri, and 1.7 per cent of the fibroids were sarcomatous. The most extensive recent figures, collected by Miller (8) show that from 9,750 consecutive cases by twenty-six operators the percentage of sarcomata found in myomata vary from none at all to 6 per cent and average 1.96 or 2 per cent.

Fibromata of the uterus are prone to so many degenerative changes that with exceptions, a sarcomatous transformation in a myoma is difficult of gross diagnosis. Metastases visible at operation or suspected from clinical symptoms are very important. The fibroid in which the malignancy is imposed is, as a rule softer than the usual non-degenerating tumors of this type. It is also darker and more congested.

On section, the sarcomatous tissue is softer as a rule more yellowish white in color and has less stroma than the firm, glistening white fibrous surface of a cut fibroid. The margin of the malignant growth is rarely sharply defined and anes in its regularity. No encapsulation is to be made out. The cut surface usually shows a small irregular yellowish areas of necrosis and limited areas of interstitial hemorrhage. There may be cystic areas from dilated lymph spaces or liquefaction of necrotic foci. The tumor tissue is in close contact with the blood spaces with extension along the large vessels.

**Symptoms.** The symptoms of uterine sarcoma are not definite. In general, they are those of carcinoma. A watery or blood tinged vaginal discharge, bleeding, menorrhagia, or metrorrhagia are the first signs in one half the cases. Menorrhagia during the menopause pain in the tumor independent of menstruation and an abundant thin, watery discharge after the menopause which does not lessen with the progress of the disease, all are common symptoms of sarcoma of the uterus. The uterus is softer and less resistant. It increases in size more rapidly and to a greater degree than with carcinoma. Pain is a more prominent symptom with sarcoma. There is possibly more profuse bleeding and less breaking down than with carcinoma. Metastases are less common (one-quarter of all cases) and occur later than with car-

dioma Uterine tumors, congenital or before puberty, excluding those produced by embryonal defects, are most frequently sarcomata. Sarcoma is also relatively more common after than during menstrual life.

Should a uterus containing fibroids increase in size more rapidly than is explained by the fibroids excluding pregnancy, sarcoma should be suspected. Increase in size after the menopause should always suggest sarcoma.

*Etiology* The etiology is as yet a secret which science has not learned. When discovered it may be the same or one closely allied to the factor that causes carcinoma the discovery of which is to-day our greatest medical problem. That the etiological factor of sarcoma will differ in some respects at least, from that of carcinoma seems reasonable since the two malignancies although frequently affecting the same organs do so in different proportions at different periods of life under non similar circumstances and originate in different tissues.

*Microscopic study* The final diagnosis of sarcoma of the uterus almost always rests on the microscopic picture and even then is frequently difficult. Heretofore the personal equation has been even more important than at present but as we are getting better and more uniform pathologists and surgeon-pathologists, our diagnoses and statistics are becoming more uniform.

As stated above uterine sarcomata fall into round or spindle cell varieties and are of small or large cell types. There is often no sharp line of demarcation between the large and small cell types, as these as well as the two varieties (less marked the latter) are sometimes considerably overlapped. The growths consist of a rounded or slightly irregular homogeneous mass of cells with but little intervening tissue and they are rarely encapsulated. In general the sarcoma cell is of an embryonal type arrested at an immature indifferent stage of its development. The cells show greater individuality with variations in size, shape and nuclear chromatin and it is only when these characteristics and variations are present that we are justified in diagnosing sarcoma.

The tissue cells in which the sarcoma occurs show a hyperplasia, also a heteroplasia or a change from the usual type. They show variations in size with large and small cells seen side by side. The nuclei are relatively large often as large as the original connective tissue cell and are irregular in outline, they stain with more or less irregularity and frequently show mitotic figures as well as evidence of direct division.

The preponderance of cellular constituents over the connective substance the reverse of mature connective tissue is characteristic of sarcoma. Connective-tissue fibers are seen permeating the cell masses and often lying between individual cells a feature never seen in carcinoma. The blood supply is good as a rule if not sufficient degeneration occurs. New blood spaces are formed lined with but a single layer of endothelium in direct contact with the tumor-cells whereas in carcinoma there is always more or less connective tissue intervening between endothelium and tumor tissue. It is not uncommon to find blood spaces choked with tumor-cells, showing beautifully the process of metastasis by the blood stream.

In the spindle-cell variety the nuclei stain more irregularly than in the round-cell variety the smaller nuclei staining the deeper. The nucleus is relatively larger and more completely fills out the tumor-cell, the edges of which are more rounded than those of the connective tissue cell. The cell-bodies may be quite closely packed or may be separated by a homogeneous ground substance which is traversed by the fine connective tissue.

The round cell variety shows masses of homogeneous cells with or without areas of limited and localized necroses and but little stroma. The cells have round or oval vesicular nuclei of uniform size. Many fine blood vessels and a fine connective tissue stroma divide the tissue into alveoli. Necrosis is usually marginal and here the connective tissue stroma can be seen uniting with the peripheral connective tissue. In this variety, especially in the large round cell type there may be a marked cordlike arrangement of cells showing transitional forms sharply distinct from the rest of the tissues and having

a loose arrangement simulating epithelium and therefore carcinoma. These cords in section appear as rounded or polygonal cell-nests, giving an alveolar appearance so common in carcinoma but close observation will show a fine network of connective tissue in close approximation with the cells traversing these nests and uniting with the connective tissue of the stroma at the periphery.

In fibroids undergoing degeneration, to distinguish a sarcomatous transformation is sometimes difficult. However when only degenerative changes are present the elements represent fully formed, mature tissue and the individual kinds of cells are uniform in shape, size, staining, and so on.

**Treatment.** Whenever sarcoma of the uterus is diagnosed positively from curettings, or is strongly suspected after careful consideration of all diagnostic factors, as complete a hysterectomy as is possible should be done immediately identical to that done for carcinoma.

If sarcoma is diagnosed as early as carcinoma the results should be more satisfactory than with the latter condition, since metastasis is slower and at a later stage of the disease. Miller states that of 180 cases impartially chosen from the literature, 127 per cent were free from recurrence after one year or more. Eighty-one cases died from the operation and recurrence and 76 cases were not followed excluding these there were unfavorable results in 79 per cent.

Fibromata are often removed solely for fear that they may become the seat of sarcoma. At present this is not justified since Miller's figures show that 6,646 consecutive radical myomectomies by twenty-two operators were accompanied by a mortality of 4.87 per cent, whereas not more than 1 per cent of myomata become the seat of sarcoma. Promiscuous myomectomy is especially unjustified since we are learning what favorable results may be obtained by the judicious employment of the X-ray. If hysterectomy always be done in suitable cases, operative procedure is more justifiable, since a certain proportion of myomatous uteri which do not become sarcomatous develop carcinoma. In the hands of competent operators panhyster-

ectomy should always be done for myomata in women near or past the menopause who require operation, or the mistake described in one of the following cases will be made.

The following two cases of sarcoma of the uterus I have seen and wish to report in more or less detail.

**CASE 1.** Gyn No 5,243. Mrs R. 48 years of age married 29 years III para youngest child 7 years old.

**Complaint.** She had had backache with pain in the left side for seven or eight years metrorrhagia for the past four months menorrhagia for the past four years heavy dragging sensation in the lower abdomen and pelvis.

**Family and past history.** Unimportant.

**Menstrual history.** Menstruation began at 15 formerly every four weeks, but had been irregular for the past four years formerly four to five days duration, now eight to ten days. Last period four months previous to admission, lasting for fifteen or twenty days.

**Present illness.** For the past four years her periods had been irregular and increasing in amount, lasting eight to ten days instead of four to five days. Seven months prior to admission she had had uterine hemorrhage lasting for several days. One month later she had similar hemorrhage though less severe. Three months later she had a similar hemorrhage, except that this last time the discharge had had some odor. She was then curetted and had no subsequent bleeding. These hemorrhages did not coincide with time for menstrual periods.

**Physical examination** was unimportant except that the pelvic examination showed a relaxed vaginal outlet the external os was patulous, and the uterus was enlarged to the size of a fist and irregular in outline. Both tubes and ovaries were slightly enlarged and adherent. White blood corpuscles 8,000 haemoglobin, 85 per cent. Urine showed a trace of albumin, but no casts.

**Operation.** Supravaginal amputation of the fundus uteri, bilateral salpingectomy, right oophorectomy, appendectomy and separation of adhesions. The abdomen was opened in the midline below the umbilicus the adherent tubes and ovaries were separated and removed with the fudex. Each showed several myomatous nodules. Peritoneum was stitched over the raw areas. The appendix was adherent and was removed. There was no glandular enlargement the gall bladder was normal. The abdomen was closed in layers. The patient's recovery was uninterrupted except for slight infection of the abdominal wound. She left the hospital on the thirty-fourth day in good condition.

**Pathological report.** Gyn Path N 4,773. Specimens: uterus, both tubes, right ovary and appendix.

The uterus, Fig. A, was enlarged measuring 8 8 7 cm. It was smooth and firm, and had no

irregularities on its surface though firm area as felt in the middle of the anterior wall. It was opened by splitting the anterior wall which was 3 cm in thickness. The dome of the tumor was thin smooth and pink. On the posterior wall there were slightly raised areas of pink growths which had a firm tissue which were rather firm and oval which the endometrium was intact (Fig. A). Situated in the anterior wall depressed 1 to 1.5 cm (Fig. A) as a tumor the size of a golf ball as firm, non-encapsulated and though rich in blood elements but were easily separated from the fibrous connective tissue from the growth as of grayish flow color with small red dots of deep yellow which were probably areas of necrosis. The growth was ill defined and spread irregularly out into the thickened muscular wall and continuity could be traced to the remnant of Fig. A which are therefore tumor tissue.

The tubes measured 9 cm in length and 4 cm in diameter. Their surface was rugged and covered the peritoneum torn lumina patulous and both ends open. No nodules were felt.

The right ovary measured 5 cm in the surface as roughened though regular outline and covered with fine fibrous. No cyst or palpable nodules were present. The ovaries were normal. Hardened intact.

*Uterine wall and endometrium.* Uterus. The tenne (Fig. B) from remnant (Fig. A) which is characterized of all cases above slightly atypical musculature (Fig. B) more or less densely invaded by a new growth. Areas showing the greatest invasion are almost out of uterine musculature and the invading cells present in clumps or of mass or strands varying from one to eight cells in thickness (Fig. B). More or less connective tissue is seen in every direction rimming between the columns of cells and ven between the individual cells which is so common in normal. There is absolutely no semblance of encapsulation or circumscription the growth seems to be running wild. The



Fig. A. Growth presenting in uterine cavity 1 to 10 cm in uterine wall, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

ascularity is not marked and seems even less than normal though no necrotic areas are seen microscopically. There is more or less dense infiltration with small round cells and few leucocytes, especially where the invasion is the more marked.

Further out the musculature (Fig. C) the malignant cells are seen in much larger columns or bundles or nests in immediate contact with the muscle fibers (Fig. C) or plugging endothelial lined spaces some of which are blood vessels as the external coat are readily distinguished (Fig. C) and others are lymphatics thus proving beyond question the possibility of metastases by either blood or lymph channels. The centers of these outlying nests occasionally show some cellular infiltration with moderate necrosis in their centers (3) (Fig. C). The outline of the individual cells, being compact

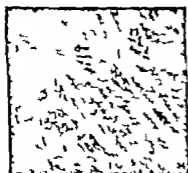


Fig. B. From Fig. A. Uterine muscle clumps and columns of cells, 3 blood vessels.



Fig. C. Cell nest in contact with muscle fibers, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

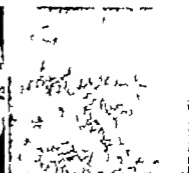


Fig. D. Less stroma than in Fig. B. Not larger more irregular staining nuclei than in preceding figures more marked round cell infiltration.



Fig. 1. Blood vessels, 2, area over blood; 3, tumor growth in uterine cavity.

is not seen except where more or less widely separated. Here they are slightly irregular, light staining, with coarse and rest of three times the size of the nucleus. The nuclei are rounded, oval, or slightly irregular and though varying somewhat are more or less regular in size and average about twice the size of leucocyte. The nuclei stain quite uniformly and are moderately deep. Fine granular chromatin, more or less clumped in some, is easily made out in the nuclei.

Occasionally mitotic figures are seen, but the cells undergoing direct division are the predominant type of cell multiplication. These dividing cells are swollen and with their nuclear poles constitute giant cells.

The division and separation of the malignant cells by the muscle and fibrous tissue trabeculae which are so marked generally and made out though faintly even in the outlying nests, some of which have a lobulated alveolar appearance, this feature with the previously mentioned characteristics seems to justify diagnosis of sarcoma.

A section at 4, Fig. 4, (the site of amputation) shows cell nests in the muscle which unfortunately make recurrence inevitable even though metastases had not already taken place.

**Right ovary.** One block (Fig. D) shows an almost solid mass of malignant cells, there being present but a narrow strip of ovarian capsule and no cortex whatever. The cells are more massed and there is relatively less connective tissue than in the uterine growth, as here no marked trabeculae are seen. The connective tissue present is fine and ramifies between the individual cells. Here only moderate degree compared to the uterine growth are the strands and columns of cells present.

The cells themselves are considerably from those seen in the uterine growth. But few cell bodies are distinguished and the nuclei are very much larger and more irregular in shape, being elongated, oval and of many irregular shapes. Though the nuclei stain irregularly as rule many deep and irregularly stained ones are seen. The chromatin is coarser and more granular and both direct and indirect divisions are much more in evidence than in the uterine growth. The round cell infiltration is marked. A section from another area shows small nests of cells similar to those just described but with abundant connective tissue surrounding them.

These growths are no doubt the same as that seen in the uterus and are metastases from that source, the growths being so small as to have been undetected in a normal sized ovary until sectioned. The larger ones rapidly proliferating cells are probably due to better blood supply in the ovary than in the uterine wall.

**Right tube.** The walls are somewhat thickened and their surfaces show evidence of adhesions. In the wall there is a small group of cells distinct from the surrounding tissues; they are densely packed in the connective tissue which does not seem to enter the mass. The cell bodies are but very indistinctly made out though they seem to be somewhat spindle shaped. The nuclei are uniform in size being about twice the size of leucocyte, rounded or oval in outline, staining vesicular and uniformly and possess very fine granular chromatin which in places is grouped in large granules and is very deep staining. This is considered as early metastases.

**Left tube.** Like the right tube but without evidence of metastases.

The appendix shows chronic inflammatory condition at the base and obliteration of the lumen at the distal end.

**Diagnosis.** Large round cell sarcoma (alveolar type) of the uterine wall with metastases to the right tube and ovary.

**CASE G.** No. 5 Mrs. L. 53 years of age, widow for 5 years had been married 31 years ago, 1 para 7 years ago.

**Complaint.** Pain over the entire lower abdomen and back also (but very occasionally) bloody vaginal discharge.

**Family and past history.** Unimportant except that for twenty years she had had frequent attacks of weakness and exhaustion, this increasing each year yielded to treatment.

**Menstrual history.** Menopause several years previous.

**Present illness.** Dated back about one year at which time she first noticed thin watery discharge which gradually increased in amount and recently as frequently blood tinged. For weeks before admission she had a large gynecological softened uterus made out with more or less necrotic material which was taken for sloughing blood projecting from the cervix. This was lobulated



direct diapedesis (Fig. F). The nuclei stain irregularly from light vesicular to deep blue. The cell-bodies cannot be well made out but seem compressed and irregular in other areas where not so compact they are slightly spindle shaped and here the nuclei are slightly elongated. Between the cells no connective tissue is made out. Some blood vessels are seen, but they do not seem excessive or dilated. Here and there are seen areas of pus cell infiltration.

**Uterine wall.** Some sections from the uterine wall in the neighborhood of the growth macroscopically not involved, show microscopically muscular tissue only slightly infiltrated with small round cells and an atrophic normal endometrium. However where by the naked eye the wall was seen involved the malignant condition is quite beautifully shown microscopically (Fig. G). The cells however seem to be more spindle shaped than in the loose uterine growth and some slight amount of connective tissue is seen in the strands and bundles of invading cells. These strands and bundles extend but very short distance into the musculature, indeed they are quite superficial. They come into immediate contact with the muscle cells (Fig. G) having no law or order in their progression and appearing as if they might be eroding the muscle wall. When they meet muscle fibers perpendicularly they

seem to encounter less resistance and in a deeper than when they attack the fibers at right angles. Numerous capillaries in direct contact with malignant tissue are seen. The uterine wall in the immediate neighborhood of the malignant involvement shows considerable vascular increase, congestion, and round infiltration.

**Ovaries.** Both ovaries are sclerotic. In the parametrium, seen in section of the left ovary there is a definite metastasis, the cells appearing quite like those described invading the uterine wall.

**Cervix.** No glands are seen nor is any malignant involvement made out. The musculature and fibrous tissue is slightly swollen and stains deeply.

**Diagnosis.** Large round cell sarcoma of the endometrium.

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## DACTYLOCOSTAL (OSSEOUS AND CARTILAGINOUS) RHINOPLASTY

B. EDWARD G. BLAIR, M. D. LAURENCE CURT MASON

**T**HE term rhinoplasty is here used in its most comprehensive sense and includes restoration from the three gross deformities that are common in the nose: *first* entire absence of any external nasal tissue and septum; *second* preservation of the skin and cartilages covering the nose but collapsed from the entire loss of septum and columns; and *third* from loss of upper lateral cartilages and partial loss of the septal cartilage and nasal bones—the very common “middle nose.” The procedures which are here offered for the correction of these deformities are to some considerable extent susceptible to inter-change under modification and the methods applicable to all the minor defects in the nose.

In the correction of the condition where entire loss of nose exists these essentials must be attained an integument practically

free from scar covering the half of a pyramid diagonally sectioned and projected from the face with two openings in its base for nostrils and with a septum. If these features exist, it is surprising how little or how much passes for a nose. It is unnecessary to refer to the ancient methods of the French, Italian, and Hindu schools except to say that none of those operators produced even the first requisite.

In 1886 beginning with König the German surgeons began the use of osteoperiosteic flaps for projection but these were lacking in the other essentials and for the most part were unworkable.

The method here presented for the total absence of a nose embraces the use of a finger out of which the essentials are first constructed before attachment to the face. The ring finger of the left hand is selected,

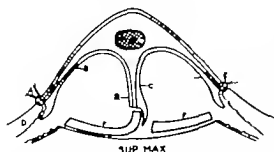


Fig. 2 A A, widened dorsum of finger B B skin of chest all lining C C Thiersch graft lining D D bifurcated facial tissues E E bone of finger F F tissue covering nasal floor

split throughout its entire length on the anterior surface and cross-sectioned at the proximal flexion through the tendons down to the bone. The skin and subcutaneous tissue of one side is laterally dissected well around to the dorsum a similar dissection of the other side carries with it all the tendinous tissue leaving the front of the phalanx bare of soft tissue and the finger trebled in dorsal width to maintain which the margins are sutured to a plate of celluloid applied on the back. The distal joint is excised for ankylosis. To further maintain this width and furnish the foundation of the septum a flap of skin and subcutaneous tissue is turned back from the chest wall as was done by Baldwin larger in dimensions than the split surface of the finger and left attached up to this attachment the opening is immediately sutured. The finger is now brought into contact with the chest flap raw surfaces together and sutured at the margins. This position is kept for one week by adhesive slings, at the end of which time

section of the flap from the chest is made under local anesthesia and its amalgamation with the widened finger is allowed to grow to the state of perfection. When this is reached the half of the finger carrying the tendons is again split from the margin to and beyond the median line throughout its length in a flat plane and beneath the tendons. This flap then is flatly turned over on its other half as the leaf of a book exposing the double raw surface over which one Thiersch skin graft is immediately applied. When this has healed a free comb of tissue projects from the middle of the finger—made up on one side of chest wall flap on the other of Thiersch graft with tendinous and subcutaneous tissue in between.

As soon as these newly fashioned tissues become pliable and before too much shrinkage occurs the finger is applied to the face in the following manner. The margin of the facial opening is incised throughout its entire circumference well inside the nasal cavity. The contiguous soft tissue on the cheeks is freely lifted with a periosteal elevator and is carried well up to the frontal bone above. A small flap is now turned up from the floor of the nasal cavity and left attached at the median line a similar flap is sought in any available tissue inside the cavity above. In the finger the nail and dorsal tissues are removed back to the distal knuckle and the bone made bare the margins are freshened by turning a small Lane flap from above downwards as far in length as the middle knuckle the flaps slipped under raw edges of the facial tissue with the integumental

From Larynx & Otol. 1911, 17, 700

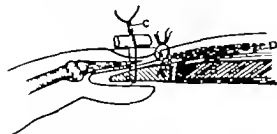


Fig. 3 A a cartilage B rib C silver wire anchor age int ja of split finger D chest all integument

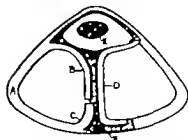


Fig. 4 A, complete nasal integument B flap turned from middle nose C flap turned up from floor of nasal cavity D dorsal flap of skin turned down from finger E, bone of finger F granulating surfaces overposed



Photograph 1



Photograph 2



Photograph 3

Group 11 case in which there is an entire absence of bone (Photograph 1) even to the extent of partial traction of the contiguous tissue of the face into the nasal opening, condition doubtless due to hereditary syphilis. Our procedure was to supply this defect by splitting the nasal pharynx of the nose finger and suturing them to a celluloid plate applied to the dorsum (Photograph 2) then applying this flap of skin turned back from the chest all (Photograph 3) and after seven days detaching subsequently splitting this tissue thus obtained loop and tucking into the middle of the finger turning this over and applying large Thiersch skin graft, thus making a core of soft tissue the beginning of septum (Photograph 4) then removing the nail the distal joint already having been stiffened, and suturing the finger to the freshened edges of the facial tissue holding it in place by a plaster cast (Photograph 5). After six days amputation of the finger from the hand was performed the proximal phalanx was split and set out the superior maxillary bone at right angle to the portion sutured to the face to form the base of the nose. Through slits of the split phalanx rubber tubes are inserted to main-

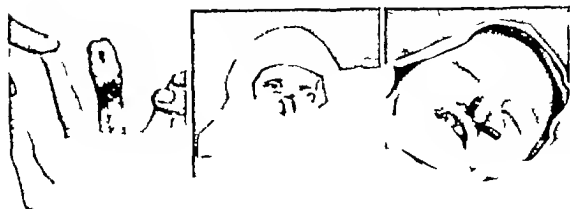
tain the nostrils (Photograph 6). Through failure to observe properly the interference to the circulation brought about by the angular device of the handle, most of the proximal phalanx atrophied, leaving a small contracted nose, as indicated in Photograph 7, with small contracted nostrils which might be considered reasonably satisfactory but look as not satisfactory to us. A story read but look as not satisfactory to us. A story read but look as not satisfactory to us.

helped for something better. To correct this deficiency then on November 7, 1913, the end of cartilage of the middle finger was turned up and sutured to the split first phalanx of the middle finger. After ten days one and one half inches of this rib and cartilage was detached and allowed to thoroughly establish circulation from the finger, as shown in Photograph 8. subsequently, the nose already obtained was split loop and the wings turned back, exposing the bone of our former finger over this then was superimposed the rib and cartilage of the finger and sutured to the wings back had been turned back. Ten days later the rib was amputated from the finger and the finger restored, the rib having splashed circulation supplied by its attachment to facial tissues. Photograph 9 shows result of rib-grafting February 6, 1914, after section from finger.

section of these assembled tissues is seen in Fig. 1.

The finger is held in contact with the face as illustrated in a plaster cast. The length of time it should be kept so is not determined by days, but after five days by tourniqueting the finger with a small rubber band shutting the blood supply from the hand, and observing the circulation from the face. The operation is now well established that this procedure

surface toward the nostril. Similarly freshened margins are made on the finger combined to be attached to the nasal flaps above and below. The bare ungual phalanx is now passed under the edges of the soft tissues above and anchored by a suture passed through them and the phalanx and tied over a piece of gum tubing. The marginal face and finger tissues are sutured with simple interrupted sutures of silk. A cross-



Photograph 4

Photograph 5

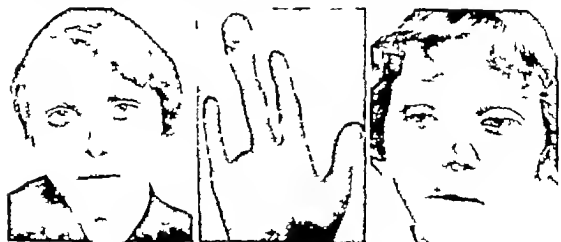
Photograph 6

Group 1 for description see legend under Photographs

and 3

done each day for from fifteen to thirty minutes under inspection stimulates the establishment of the facio finger circulation and reduces the length of time in the cast. In the original case amputation was made in nineteen days but it was recognized that it could have been separated in fourteen. Another physiological observation worthy of note is that at the end of ten days the patient voluntarily said "My finger down to there (meaning the middle knuckle) feels like my nose the rest of it like my finger."

When the circulation is thoroughly established from the face amputation is done at the metacarpophalangeal articulation, and the projecting phalanx is reflected backward so that the middle articulation can be removed with a rongeur to ease the tension in the dorsal tissues and prevent the ischemia resulting from extreme flexion of this phalanx when it is set into the tissues covering the superior maxilla to secure projection. Before this is done the soft tissues of the phalanx are slit on each side close to the bone and



Photograph 7

Photograph 8

Photograph 9

Group 2 For description see legend under Photographs

and 3



Photograph

Photograph 2

Photograph 3

Group Photograph. Collapse of nose due to entire loss of septum part of alar and superior lateral cartilages March 28 9 3 German Hospital Kansas City Missouri

Group Photograph. Front view of result obtained by wing finger according to technique described July 9, 1912

Group Photograph 3. Side view of same July 9 1912

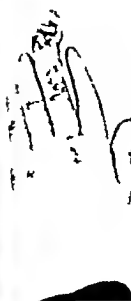
carried to the face for suturing. The middle portion is set into a transverse incision made into the maxillary tissues down to bone and sutured in place. Freshened edges of the septal tissue are made and brought into contact as the flexion is made. There are now no raw surfaces exposed except the margins of the alts, and into these gum tubes are placed to allow for healing and formation of the nostrils.

If for any reason there is insufficient projection, or if from contraction more tissue is desired the following plan may be utilized successfully. A flap of chest wall is again used similar in shape to that used before but made over a rib including its cartilage and all the tissues down to the pleura. The cartilage of the rib is sectioned and the free end in the flap turned up. The soft tissues of the middle finger of the left hand are now split in a flat plane anterior to the bony phalanx back to the distal flexion. Into the jaws of this incision the projecting rib cartilage is set and anchored by a silver wire inserted along one side of the nail inward and through the cartilage and out again on the other side the ends being twisted over a piece of tubing placed over the nail

The skin of the upper jaw of the finger is sutured to the free end of the skin of the chest wall, and contact of the lower finger flap is made by the introduction of packing introduced to elevate the rib and prevent its reunion. After ten day section of the rib-flap was completed one and one-half inches away from the point of finger contact. In this way the finger was made the carrier of chest wall, including skin rib and cartilage (Fig 2) one and one half inches in length by one inch in width. This union was continued with the hand free on a simple splint until the vitalization and formation of the graft was what was desired. Three weeks time was given to this with only slight shrinkage. The former finger nose was then split in the median line from a point above desired to the tip down to the bone and the nasal covering dissected off laterally making two wings of soft tissue. Former dorsum of the finger. Perfectly healthy bone and septum were revealed, but were somewhat retracted. The margins of the chest wall graft were freshened as were those of the widened finger and this tissue was superimposed on the exposed bone with which its freshened granulating



Photograph



Photograph



Photograph 3

Group 3. Photograph. Primary condition of saddle nose of moderate degree. Operation January 9, 1914. Rib anastomosis and rib anchorage. German Hospital, Kansas City, Missouri.

Group 3. Photograph. Exhibits again growing of

rib on finger this time about 4 cm of chest, all covering. Cartilage covered rib prosthesis granulations February 1914. Rib anastomosis and nose as made as described.

Group 3. Photograph 3. Shows result fourteen days after section of rib cartilage from the finger.

under surface was brought into contact. Anchoring facial suturing and maintenance was the same as before. On the tenth day the finger tourniquet indicated the feasibility of sectioning the finger from the graft, which was done leaving a vital rib implanted with chest wall skin growing a fixed part of the nose. The small fragment of cartilage left in the finger was removed and the finger restored.

When in the case of a collapsed nose, a finger is used as a wedge done by Finney, a primary plastic sectioning is done for the construction of the septum. Starting well over to the left side of the nasal covering flap is dissected off on the inside of mucous membrane with some effort to include portions of cartilage and the dissection is carried well over to the point opposite and left attached to hang down. A similar flap is turned up

from the nasal floor to join this. When the dorsum of the finger is denuded it is done by making a flap of those tissues, starting well over on the left margin of the dorsum and carrying the dissection to the middle of the anterior surface of the finger where it is left to hang with its raw surface to be apposed to the raw surfaces of the two nasal flaps already made, making a completely lined septum and with the surface created above by the dissection from the nasal integument coming into contact with the denuded finger, no raw surface whatever is left. The assemblage of these tissues in section is illustrated in Fig. 3. The pharynx remaining free projection is thickened only at the point where it joins the septum and its shrinkage is left to tube pressure in the nostrils, which is kept up until it is accomplished most of the time being inserted only at night. By the sacrifice of a finger in this way a perfect



Figs. A and B examples of tibiofibular separation, comminution of the lower end of the fibula with displacement of the astragalus out and but not in the antero-posterior axis.

Figs. C and D bimalleolar fracture with some backward displacement of foot due to epiphyseal separation of tibia. The ligaments undoubtedly hold in the rear and there is no lipping fracture.

particular attention to the position of the astragalus in regard to the weight bearing axis and lipping fractures with callus thrown out that would interfere with ankle motion.

#### ENUMERATION OF RADIOGRAPHIC STUDY OF THE ANKLE FRACTURES

1 internal malleolus alone	40
1 internal malleolus with fracture internal lateral ligament as evidenced in skigram	3
1 internal malleolus alone	
Both malleoli	47
Appreciable separation of interosseous ligament	
Both bones fractured above epiphyses	
Fracture external malleolus and epiphyseal separation lipping fracture	6
Marked displacement of astragalus	
Forward	5
Backward	6
Out and	5
Result: setting—using tibio-astragal axis as base	
Good	38
Bad	27

Analysis of these figures demonstrates that fracture of both malleoli is about two thirds

as common as fracture of the external malleolus alone that it is five times as frequent as fracture of the internal malleolus alone, and about once and one half as frequent as fracture of the external malleolus plus fracture of the internal lateral ligament. If external malleolar fractures alone and with internal ligament fracture are considered, they are twice as frequent as bimalleolar fracture. These figures also show that lipping fracture occurs in at least 10 per cent of these ankle fractures and should be watched for in every case and that good results, as demonstrated by the skigrams, are not obtained in more than four-sevenths of the cases treated. Colvin of Saint Paul, analyzing 60 cases of ankle fracture reports about one fourth as consisting of fracture external malleolus, one fifteenth internal malleolus alone and nearly one half as bimalleolar. He notes only one case out of sixty as consisting of fracture of the fibula and rupture of the internal lateral ligament, calling this the only true Pott's fracture in the series (fibula three inches above joint and rupture internal lateral ligament).

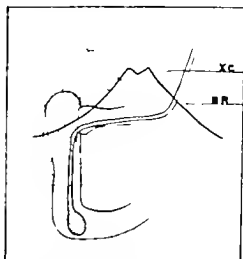
Considerable has been written lately concerning a mathematical calculation of the prognosis of ankle fractures from skigraphic study, taking as criteria the lines or axes of weight bearing force and the correct relation of joint surfaces. If these are good—that is, if the joint surface of the lower tibial end and the astragalus bear a correct relation to each other and a line drawn through the weight bearing axis of the leg from the anterior superior iliac spine straight down through the patella passes through the middle of the astragalus body—the prognosis for a useful weight bearing function of the foot and ankle is excellent. It is said that one can disregard the position of fragments if these points are satisfactorily established but I believe that stand is not well taken for the powerful supporting lateral ligament of the ankle attached as they are to the lower tips of the malleoli above must be replaced in a position of relative balance and allowed to heal in that position before useful painless function can be hoped for and this can only be accomplished by replacing these coils in

peristalsis, perhaps only by means of general tonic contractions. Thus it appears that the bulbous duodenum has a special duty to perform: it acts as a buffer against the spurning of the antrum as well as a kind of secondary stomach. On the other segments of the duodenum the contents progress as coin sized bits with unclear margins which do not unfold or completely fill the duodenum in any part. This progression occurs in periods lasting several seconds and alternating with periods of rest which may last for minutes. The first station is, as a rule, between the pars media and the pars inferior the next in the jejunum.

Of pathological conditions in the duodenum we have known, up to the present (1) the plexes (Chiladiti) and (2) the tumors (Holzknecht) with the following radiological syndrome:

1. Filling of the duodenum above the seat of the stenosis so that the wall of the duodenum is hardly outlined. 2. Intellectual or partly effectual peristalsis of the filled duodenum causing a change in the form of the organ but no change in position of content. 3. Retention above the stenosis. 4. (Kurzweil) of paralytic dilatation above the stenosis.

Both retention and dilatation can involve the stomach as well as the duodenum. The stomach almost always retained in the lower part of the upper part of the duodenum more rarely in stenoses in the neighborhood of the duodenojejunal flexure. The distention is of moderate and organs of the stomach are rarely possible. The diagnosis is difficult when the patient has not produced a tumor with slight possibility. The indication of histamine in the duodenal ulcer could at this time be directly diagnosed from the roentgen picture. It was possible only to make a probable diagnosis from the clinical history and an undoubted and in some cases with the history of general well-being. In type I and II the present perhaps symptom is the going from day to day and at night and not corresponding to the size of the duodenum. A duodenal ulcer is rarely found and George and Gerber found that the



XC Xiphoid cartilage BR Border of the duodenum and line in jejunum (not a line) in jejunum

directly diagnose duodenal ulcer by means of serial radiography. Our limited experience at that time did not permit us to realize the real value of their work.

Within the last two years eight or nine men independently of each other came upon the idea of filling the duodenum with barium through the duodenal tube. Skinner in Kansas City was the first so far as I know to try it, and the experimental stage I did the first but six months, but was unable to get uniformly good results because the barium flow was slow through the duodenojejunal flexure or it halted in the jejunum or it was not in sufficient quantity for any length of time as the peristalsis was aimed at further. Finally with Holzknecht I made the addition of work by the very simple expedient of putting his distention tube into the duodenum along the duodenal wall at the duodenojejunal flexure which he led through the stomach and not following any previous method made. After that for our with the distention tube we were able to dammed back the stomach and secure complete filling of the lower part of the duodenum and a clearing of the rest of the jejunum.

result can be obtained but with the success of chest wall transplantation, it is obvious that with the application of a Thiersch graft to its under raw surface it could as well be used in much the same manner and the finger saved.

In the correction of the saddle nose the method of transplantation of a chest-wall flap was put to a second test. In a moderately depressed nose the rib was attached to the finger as before but after sectioning from the chest wall its dorsal skin was lost by sloughing, probably from insecure suturing to the finger or undue mobility subsequently. The integrity of the other tissues, however, was preserved, and in two weeks the rib-cartilage was completely enveloped in a most prolific covering of healthy granulations. To apply this to the nose the columna was divided at its junction with its dorsal cartilage and the section carried through the

septum to the margins of the nasal bones the depressed soft tissues were then freely elevated on both sides and above. The granulations on the graft were shaved well down to the cartilage until it was fashioned exactly to correct the deformity then it was passed into the nasal pocket created for it, anchored, sutured, and kept in a cast much as before. This was maintained for only one week when it was separated from the finger and has remained perfectly without shrinkage. The columna later was restored.

In five cases of deformity treated by these methods, one complete nose was successfully constructed (Case 1) three elevations of collapsed nose with loss of septum were made by use of the finger (as represented in Case 2) twice the rib was carried by the finger once for the improvement of the finger nose and once for the correction of a saddle nose deformity (Case 3).

## THE DUODENUM A RÖNTGEN STUDY

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UP to the present we have known but little of the physiology or pathology of the duodenum in the roentgen picture. In most cases shortly after the ingestion of a barium meal a shadow appears in the duodenum—the bulbous. This is of great importance in determining the position of the pylorus, which is easily recognized as a linear cleft between the pyloric portion of the stomach and the duodenum. What little could be seen in the normal duodenum was described by Holzknecht in the following words: "The fluid content of the stomach passes into the duodenum in two ways. First, without help of the entricular peristalsis for example when a barium water suspension which does not require stomach digestion is taken on an empty stomach with open pylorus. Second by means of antrum per-

istalsis the stomach rhythmically empties its fluid contents into the duodenum. The jets of gastric contents collect in the first half of the pars superior duodeni. Its breadth and easy dilatability break the force of the stream which is propelled through the pylorus. The chyme halts here for a short time before it proceeds upon its relatively rapid course through the rest of the duodenum and small intestine. Small amounts may remain here for a long time perhaps undergoing a secondary digestive process similar to that in the stomach. When the contents exceed the capacity of this segment the excess is seized and carried away by the peristalsis and the freshly arrived barium lies in its place. The exceptional function of this part of the duodenum made it desirable to give it a special name (bulbus duodeni). This includes the widened first half of the pars superior. The bulb takes very little part in

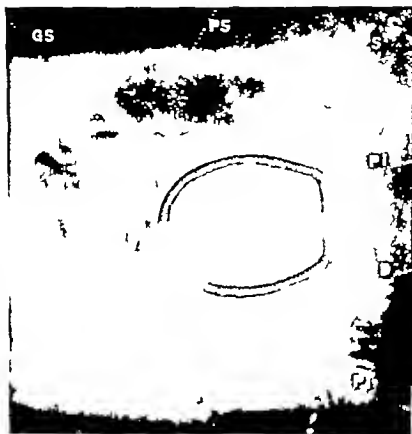


Fig. 1. The duodenum and its accessory organs. S, stomach; D, duodenum; P, pancreas; G, gallbladder; L, liver; SP, spleen; E, esophagus; SI, small intestine; LI, large intestine; A, appendix.

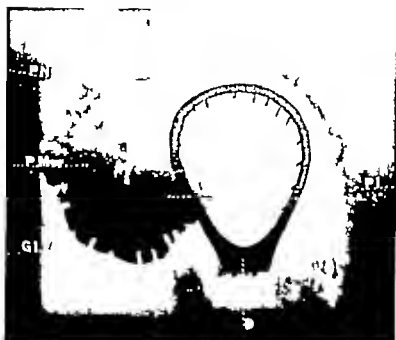


Fig. PD pars superior duodenum P pylorus, S stomach, PI pars inferior duodenum compressed duodenojejunal flexure D duodenum GI genus infimus PM pars media PN physiological narrowing J genus superior

At our leisure we can study this picture measure the time of individual peristaltic waves look for defects in the duodenum and watch the excursions of the fixed organ with respiration and with retraction and relaxation of the belly wall. In the normal case the duodenum is freely movable in all its parts. In the supine position with forced expiration, or with retraction of the belly wall only the lower pole of the duodenum is visible under the border of the ribs. This fact is difficult to bring into consonance with our present conception of the anatomy of the duodenum. Despite this I wish to emphasize the fact that the duodenum as a whole—not the pars superior nor the pars inferior alone but the whole organ—moves up and down with respiration and even more so with tension of the abdominal muscles (see Fig. 1).

My idea of the cause of this movability may be expressed in the following crude comparison. The peritoneum is applied to the internal body wall like the fabric of a man's vest to the external body wall. A watch-

chain might represent the stomach fixed to the wall in two places, movable either with the fabric when the vest as a whole moves, or independent of the fabric by pushing up the center of the chain. The duodenum might be considered as a braid sewed upon the fabric and moving only with movements of the vest itself. The diaphragm and the liver together probably serve to tense the peritoneum and thus pull up all the abdominal organs, especially with forced expiration and concomitant retraction of the belly wall.

In order to facilitate our work and save time we (Hofknecht and the author) have adopted the following nomenclature (see Fig. 2): bulb, pars superior genu superior, pars media, genu inferius pars inferior cavity and convexity.

Figure 2 shows the duodenum taken with the patient in the erect posture during peristaltic rest; notice the physiological defect at the genu superior, due first to the bend in the duodenum at this point and second to the sedimentation of the bismuth suspension

The advantages claimed for these methods of filling the duodenum with compression at the *duodenojejunal flexure* are (1) More complete filling of the duodenum with the exception of the bulb (2) observation of the peristalsis and the mobility of the duodenum fluoroscopically (3) more exact determination of the location of the tender points (4) observation of niches and defects in the duodenal picture (5) diagnosis and differentiation of duodenal adhesions or variants (6) dislocation due to extraneous causes e g pancreatic tumor

As yet the most important part of the duodenum is not attacked by the tube method. In the course of the ordinary examination of the stomach we almost always see a more or less complete cast of the bulb according to the amount of bismuth which succeeds in passing the pylorus during the examination

In the tube filling on the contrary the bulb duodeni is usually very little if at all filled. In our latest attempts we have succeeded in filling the bulb more completely by drawing the tube into the stomach after the filling has been accomplished

However the filling of the bulb with any approach to completeness is technically the most difficult part of the duodenal examination. It seems to me that a combination of the various methods (the ordinary examination in different positions of the body the observation of Cole's duodenal defects either by serial radiography or more easily by fluoroscopy with the aid of the Bucky effect effleurage with or without compression at the duodenojejunal flexure and the tube method) will best lead us to our diagnostic goal

Reichsuecht and Lippman (in press)

Reichsuecht, München med. Wchnschr. 1914 No. 49 Dec

## SYNDESMORRHAPHY AND SYNDESMOPLASTY \*

### THE OPERATIVE TREATMENT OF RUPTURED LIGAMENTS

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I APPROACH this subject with a certain hesitancy because I realize that the procedures I am about to describe have probably been practiced many times in the past. However that may be it has not been my good fortune to see them described, and I must confess that for lack of specific knowledge I have let slip many opportunities to benefit patients. Furthermore I have seen many cases in which the same might be said of other surgeons. These are the reasons for my remarks.

The word syndesmology (from Gr *syn de mos*) signifying the science of ligaments has been used. Now from the same source I desire to suggest the coining of two new words. (1) *Syndesmorrhaphy* by which, as the word indicates, is meant the suture of ligament as in the simple repair of a cut or torn ligament. (2) *Syndesmoplasty* by which meant a plastic operation on a ligament

whereby the ligament may be shortened lengthened, imbricated or strengthened by folding grafting or transplantation of other ligamentous structures to take the place of or reinforce a weakened or lacerated ligament.

Syndesmology, the science of the ligaments has not received the attention from the surgeon that its importance warrants. In fact, it has received hardly any attention at all from the great majority. The lack of knowledge regarding the ligaments has resulted in so many cripples that the belief among the laity has crystallized into the maxim "A sprain is worse than a break." This probably has a substantial element of truth in it.

In treating a fracture every endeavor is made to approximate accurately the fractured ends of the bone, or to reduce them as nearly as possible to their normal position



Fig. 4. 1 meal.

the duodenum or not. The exact time of individual waves is difficult to determine as the beginning and end of the peristaltic movement are not very well defined. Of course we realize that we are not working under nor observing physiological conditions but then again none of the radiology of the gastro-intestinal tract is done under strictly normal conditions. We merely need normal standards of comparison in our diagnostic work.

In our pathological cases the peristalsis is much more irregular the duodenum contracting rhythmically for a few wave periods, then frequently resting for minutes at a time then perhaps showing a single wave of peristalsis to relapse again into a period of quiescence. We were unable to offer an explanation for this irregular peristalsis although we knew from unpublished experiments of Dr Hruby of Budapest that after artificial excitation of peristalsis in the exposed duodenum the organ

soon enters upon a period of rest. We observed later when injecting barium in a solution of 0.5 per cent HCl that peristalsis, contrary to our expectations, was never excited and if peristalsis were present it often stopped. We thought, therefore that the excess of acid in our pathological cases might be one of the factors in the causation of this irregular peristalsis. We made further experiments on the exciting factors of duodenal peristalsis which I hope to publish in a later communication. We often take advantage of these facts by withdrawing the tube after a short period of compression combined with the injection of 0.5 per cent HCl and observing the bulb.

In our work we can see the filled duodenum observe it in action and gain the advantages which are obtained in gastric radiology by observing the motions of the barium in the stomach. For example by pressing out a coal with our distuctor or by having the patient contract his belly muscles, thus moving the duodenum upward and very often dislodging a supposedly adherent coal, we see whether a coiled duodenum is merely a variant or is due to adhesions. Then again we may turn and twist the patient, examining the duodenum in all positions. This is important as, for example when a barium blotch in the sagittal projection is easily resolved into a coil of duodenum when the patient is turned into a diagonal position. Figure 4 shows a variant the duodenum being shaped as is shown in the illustration, but every part was freely movable so that we could straighten the duodenum out into a simple curved tube. In this picture we see a filling of the duodenum without the tube but with compression of the duodenum. By this method very good filling may be obtained in many cases in others none at all. This is very prettily illustrated in a case with marked hyperacidity retention of one quarter of the barium meal after six hours and of approximately one-sixth after papaverin (gr. ) had been given (pylorostenosis?). We were unable to fill the duodenum by means of siphonage but obtained a very pretty filling through the duodenal tube.

definitely until cured by operative interference or until the patient learns, to a greater or less degree, to prevent recurrences by unconsciously refraining from assuming a position of the arm that leads to dislocation. Long-continued irritation by the movements of the arm may give rise to a chronic synovitis, eventually limiting the motion to such a degree as to prevent a recurrence of the trouble.

The acromioclavicular articulation is frequently the site of severe injuries. Falls on the shoulder, heavy weights striking the shoulder or sudden violent forces throwing the shoulder backward frequently cause a rupture of the trapezoid conoid acromioclavicular and capsular ligaments, allowing the shoulder to sag down or the outer end of the clavicle to project upward. In abnormal projection appears on the outer portion of the shoulder corresponding to the outer end of the clavicle. If the case is not seen until swelling and ecchymosis have appeared the diagnosis may not be possible until the swelling subsides. If allowed to go untreated the shoulder becomes weak and painful and the patient is incapacitated for heavy labor.

The joint that above all others, when affected, leads to disability is the knee joint. It is not so frequently affected as the others, but the disability arising from a rupture of the ligaments of the knee is very serious and lasting. This is apparent on anatomical grounds. The ligamentous structures about the knee are so strong that when they are caught at a disadvantage so that the knee cannot bend with the force the bone frequently breaks before the ligaments give way. When the ligaments do give way, however, as in rupture or sprain fracture, the length of the ligaments predispose to a wide separation of the broken ends (hence to a slow and insecure repair) while the length of the lever age and weight to be borne necessitate great strength to withstand the strain. Taking these facts into consideration, is it small wonder we find so many braces worn to assist an injured knee in performing its functions?

#### DIAGNOSIS AND TREATMENT

In the treatment of ruptured ligaments, as in the treatment of any other condition, the

prime factor is the diagnosis. This is not always easy. In cases of joint injury we should try always to detect abnormal mobility. If the examination is made soon after the injury the findings are important, while if the time for swelling and ecchymosis has elapsed it will not give a true index to the severity of the lesion. Motion that otherwise might be very abnormal is so limited by swelling, extravasation etc. as to render it normal. A careful skiagraph should be taken of the affected part to rule out fractures or sprain fractures. Then, unless a rupture is demonstrated, the affected part should be placed at rest and in due time treated by massage hydrotherapy etc. When the swelling and tenderness have subsided the joint should again be examined for abnormality. This is where the slow growing ligamentous structures stand us in good stead. An overlooked fracture unites in malposition and much callus is produced rendering a late repair very difficult. A ruptured ligament, on the other hand, makes little effort at uniting, and months after an injury it may be found practically unchanged and may be united and result in great improvement or permanent cure of the condition.

In the cases of injuries to the acromioclavicular articulation, the diagnosis can best be made, when the swelling has subsided by grasping the shoulder with one hand and the clavicle with the other where if any abnormal mobility may be detected easily by comparing the sides.

The treatment is simple and efficient. An incision is made over the outer third of the clavicle, extending over the acromion process just beyond its outer edge. The skin fascia, and a few fibers of the deltoid muscle are retracted, exposing the outer end of the clavicle, the acromioclavicular joint and the acromion process. Two holes are then drilled through the acromion process beginning at its outer edge and drilling inward and slightly downward so as to come out on the under side of the acromion just below the acromioclavicular articulation and about one half to three quarters of an inch apart.

The outer end of the clavicle is now f



Fig. Dissection of internal aspect of knee. Sartorius muscle lifted up. Forceps passed under internal lateral ligament. Tip of forceps resting upon the gracilis tendon, showing insertion of gracilis tendon at base of internal lateral ligament.



Fig. Skiagraph. Case 2. Lateral view showing patellar tendon fixed by means of suture.

and retain them in such position until healing has taken place. In treating a ruptured ligament however there is usually no endeavor at all made to approximate the torn ends of the ligament. It is not taken into consideration that accurate approximation is more necessary in the case of torn ligaments than in fractured bone. The bone will bridge over a moderate space and regenerate as strong if not stronger than before while the ruptured ligament makes but feeble effort to bridge over a space and practically never becomes as strong as before. Possibly our carelessness in the matter is due to the fact that we have nothing to show us the relative position of the torn fragments. We satisfy ourselves that no fracture exists and then neglect to find out the amount of injury that has taken place in the ligaments.

In a certain percentage of cases the rupture is only partial, and the ends remain in fair apposition. In other cases the rupture may be complete and the ends retracted on themselves, leaving a space impossible to bridge. We find the conditions exactly reversed from those found in fractures. In the latter the bone acted on by the muscular pull tend to overlap the broken ends and an opportunity is given for a strong repair while in rupture of the ligaments the bones lose their support and the ends of the torn ligament are drawn farther apart. Consequently it behooves us to

make every endeavor in cases of sprains to determine the character and extent of the injury.

The reparative powers of the various portions of the body vary greatly, but one of the slowest structures to regenerate and become strong after separation is the white fibrous tissue of the ligaments. The healing powers of an organism can do a great deal to repair the damage done in most cases when given an opportunity by rest of the affected part, but there still remains a considerable number of cases of complete rupture of ligaments with more or less retraction of the ends where the reparative powers are insufficient and we are left with a permanently impaired joint. In injuries of the ankle joint, where the ligaments are comparatively short, retraction to any great degree is impossible hence, the word we can have is simply a weak ankle suffering from recurring sprains as the torn structures are united by scar tissue and broken again when subjected to strain.

If the shoulder joint happens to be the one affected we will probably have a series of recurring dislocations which will go on in-



Fig. 3 A



Fig. 4

Fig. 3 B

Figs. 3 A and 3 B epiphyseal separation lower end of tibia with fracture of fibula and marked back and displacement of foot and astragalus. Note that anteroposterior picture shows the astragalus in its mortise and gives no information in regard to the fracture.

Fig. 4 Fracture reduced and in plaster cast after open operation.

position and reestablishing the conformity of the tibioastragaloid articulation. Of great importance also are theipping fractures involving the tibia with posterior or anterior displacements of the astragalus.

An anteroposterior skingram may not show these or a picture taken after reduction may show a good result as far as the restoration of the mortise is concerned which if further analyzed by a lateral view would show a displacedipped fragment of the tibia and give a poor prognosis for the full use of the ankle. The astragalus head rests firmly mortised between the two malleoli which lock it in and hold the articulating surface directly under the lower joint surface of the tibia which is the bone of weight bearing. As Skinner has advised the anteroposterior skingram should give us information in regard to the condition of this mortise and the exposure should be made with the center of the focus about an inch above the center of a line drawn between the two malleoli, the foot being held at right angles to the leg.



Fig. 5

Fig. 7 A



Fig. 6

Fig. 7 B

Fig. 5 Fracture of fibula and tearing off of tibial epiphyses beginning at anterior border with foot displaced backwards.

Fig. 6 Fracture of fibula releases hold of posterior ligaments. Foot evidently forced forwards by trauma causingipping fracture of anterior margin of tibia. Note how this drops down in front of joint and might be replaced and held by keeping foot in hyperflexion for few days. Callus forming about this might easily interfere with full movement of ankle.

Figs. 7 A and 7 B Oblique fracture of lower end of fibula allows no ligamentous support to joint. Astragalus shoved on back andipping fracture of posterior border of tibia. Mathematical calculation taken from an anteroposterior view as criterion.

If the lower end of the fibula has been split or twisted alone by the trauma our indication for treatment is to hold the astragalus well up against the internal malleolus and then hope to drag the cracked or broken external malleolus over to its proper position by forced inversion depending on such fibers of the external lateral ligament as are still intact. Should both malleoli be broken off our method of treatment becomes a more difficult task. Here forced inversion alone is not sufficient as in bimalleolar fracture we can always look for displacement of the astragalus either out or in forward or back according to the direction of the causative trauma, so the real indication consists in returning the astragalus to the weight bearing axis and then fixing

down into place. If the condition is of long standing it may be necessary to remove a little of the bone to allow it to be replaced. Two holes are drilled through the outer end of the clavicle coming out on the under side as near as possible to the holes through the acromion. Each end of a medium heavy silver wire is passed inward through the holes in the acromion and then upward through the holes in the clavicle. The clavicle is pushed down into place, the wire drawn tight and twisted to hold. This virtually forms a matrix suture of silver wire to hold down the end of the clavicle and bring the torn ends of the coracoclavicular ligament into direct apposition. The coracoclavicular ligament is sutured with chromic catgut and the skin is closed. The dressing is applied and the arm allowed to rest in a sling.

This operation I have performed a number of times, and the result has been very satisfactory.

The diagnosis may be made with more ease and certainty in injuries to the knee than in any others, as the ginglymus joint with its superficial position and long levers lend itself to an easy diagnosis and a hint itself to a ready repair. The X-ray helps only in a negative way but it is absolutely essential as it may reveal some unexpected conditions.

The repair is accomplished by simple suture or by a syndesmosis operation. When the internal lateral ligament is ruptured it may be reinforced by superimposing the tendon of the gracilis muscle upon it. See Fig. 1.

We may state that we have an operative condition of the ligament.

1. In frank injuries where there is a reasonable ground for supposing a complete ruptured ligament.

2. In old sprains where after the lapse of one or two months there is still distinct abnormal mobility.

3. In cases of recurring sprain leading to frequent disability we should endeavor to relieve the condition by repair of torn ligaments or by transplantation of strong fascial structures from other portions of the body.

4. In compound sprains or in compound dislocations. In these cases we should not

consider our duty fulfilled to the patient until we have repaired the main ligamentous structures by either an immediate or late repair, whichever we consider most appropriate in the individual case.

In the following case reports (one selected from each division) the first one naturally falls into the first division, the second is that of a late repair and the third is a compound rupture of the patella tendon and accessory ligaments.

**CASE 1.** J. C. fell down a embankment May 3, 1917 and in falling twisted his right knee under him. He does not know exactly how it happened. On attempting to rise he found that the right knee was swollen. He was sent to Ancon Hospital the same day. The leg was treated with elevation, immobilization, and ice. At the end of 12 days the swelling had subsided to a considerable degree and on examination it was found that the knee possessed an abnormal lateral motion. The extended leg could be abducted to nearly a right angle with the thigh showing convexity to the complete rupture of the internal lateral ligament. The straightened leg could not be abducted beyond the straight line showing the presence of unruptured internal lateral ligaments.

On May 10, 1917 seven days after the injury, under ether anesthesia I laid bare the internal lateral ligament by ligamentolysis, incision about 4 inches long over the course of the ligament exposed a well defined upper and lower limit. The ligament with rupture in lower third was easily demonstrated. The torn ends of the ligament had retracted and curled up on themselves, causing a separation of at least one and one-half inches between the ends. The expansion from the quadriceps tendon on the inner side of the patella and the joint capsule were both ruptured.

The joint capsule was opened by catgut, bile the torn internal lateral ligament and sponges of the quadriceps tendon were secured with heavy thirty-1's chromic gut. The whole ligament is reinforced by transplanting the tendon of the gracilis muscle. The peroneum on the adductor tubercle is incised and the tendon sutured to the peroneum and the origin of the lateral ligament just below the adductor tubercle. It is not necessary to transplant the lower end of the gracilis tendon, its insertion is just below the attachment of the lower end of the internal lateral ligament. It is sutured on the lower end of the internal lateral ligament by chromic catgut, thereby reinforcing the ligament with the tendon. I doubt if the tendon is not severed, but simply displaced forward and inserted in two places—once at the lower end of the lateral ligament and once at the upper end. The work is both thus accomplished may be appreciated by a glance

Fig. 1 a hasty dissection of the internal aspect of the knee. The skin was loosed and a dressing applied with a long external splint well padded at each end to overcome the tendency toward genu valgum.

At the end of ten days the dressing was removed, the stitches were taken out, passive motion was given the knee and splint was reapplied. For fear the patient might in due time injure the repaired ligament in his sleep passive motion was given every few days for about one month, at which time the splint was removed entirely and the patient encouraged to move the knee.

The range of normal motion rapidly increased, while the lateral motion was hardly perceptible. He was discharged from the hospital July 10, 1903, ten months after day from operation, able to walk with only slight limp on level ground. He had considerable difficulty going up an incline or up and down stairs. I did not see the patient again until October 9, 1903, when he was admitted to Colon Hospital. He reported that steady improvement had taken place since operation nearly a year and ten months ago and that the knee was in all appearances normal in motion and function.

CASE II. R. J. MASON, Colon Hospital No. 435, fell in front of a moving handcar in Colon September 30, 1903, sustaining compound comminuted fracture of the left leg in the middle third and rupture of the internal lateral ligament of the left knee joint. Wound was cleansed and dressed. As the position was good no retention of pus was necessary and none was applied other than an internal and external splint. At the end of ten months the fracture was all union strong and position good, but the patient was unable to walk on account of lateral motion of knee joint. The knee would buckle inward when walking was attempted.

He was treated with splints and immobilization until February 25, 1904, period of six months from the time of injury without improvement in his condition. On February 8, 1904, patient was etherized and I exposed the internal lateral ligament by means of longitudinal incision over the entire length of the ligament.

In this case I found the rupture had taken place in the upper third of the ligament. Part of the fibers had broken off just below its origin under the adductor tubercle and part of them had broken lower down causing an irregular rupture with moderate degree of separation but no effort to repair. A simple syndesmorrhaphy as performed the lower end was freed and brought up and sutured to the upper end and to the fascia and peritoneum over the internal condyle by means of chromo catgut while the leg was held in straight position. The wound was closed and dressing applied. The long external splint to prevent genu valgum and tension on the ligament until healing occurred.

Passive motion given as in Case I. Lateral motion was reduced to almost normal limits by the

operation. Improvement as fairly rapid. In two and one half months patient was able to walk with a stick. Improvement continued until June 9, 1904, when he went back to Jamaica.

The following note was made on his discharge from hospital: Knee much improved. Almost no lateral motion flexion and extension normal. Walks well on level ground. Has trouble only on going up stairs or on plane.

While the operation improved this patient immensely I believe that a transplantation and utilization of his gracilis tendon to reinforce the ligament would have given him a stronger knee.

CASE 3. H. S. COLON Hospital No. 46504, American, white, age 33, was knocked off lock wall at Gatun April 23, 1903, by a broken chain and fell into a valve pit distance of nearly fifty feet.

Among other injuries was one to his right knee which struck on the sharp edge of the concrete pit, widely opening the knee-joint and knocking off the inner portion of the tuberosity of the tibia with its attached portion of the patella tendon then rang upward and outward the patella tendon was severed the remainder of its width in an oblique direction together with the accessory portion of the quadriceps tendon. Everything was carried away as far back as the lateral ligaments.

Under ether anesthesia the wound was cleansed, the edges were trimmed, the patellar tendon was cut red with chronic catgut and that portion of the tuberosity of the tibia which had been pulled loose was pulled down and fixed in its original position by means of nails (see photograph). The skin was closed with small cigarette drain and dressed with 3 per cent carbolic dressing.

After thirty six hours the wound was redressed with the same strength carbolic dressing. After the drain had been removed. The patient ran a slight febrile reaction for six days. Stitches were removed at the end of two weeks, when wound was healed. Slight passive motion was started. Improvement was gradual.

On July 9, 1903, the patient was walking with the aid of a stick and went to the States on leave. He returned October 1, 1903, when I found the following condition: Movements of the knee were normal in flexion and extension. Patient can walk on a level plane stairs or on plane but experiences some difficulty in going down stairs. The only abnormality that can be found is a slight weakness in the anterolateral movements of the knee probably occasioned by the destruction of the accessory portion of the quadriceps expansion. Otherwise the joint appears to be normal. He states that there has been steady improvement.

In conclusion I wish to state that I believe we have been entirely too conservative in our treatment of severe sprains. I believe we should be as ready to repair a ruptured ligament as to mend a broken bone.

## THE PHENOLSULPHONEPHTHALEIN TEST FROM THE VIEWPOINT OF THE ABDOMINAL SURGEON

BY STEPHEN F. TRACY, M. D. PHILADELPHIA

PHYSICIANS long have realized what a great aid in diagnosis, in prognosis and in the selection of operative cases would be a simple and accurate method of determining the functional activity of the kidneys. During recent years many methods have been advocated, most of which have fallen into disuse, some because the technique was complicated, others because the results were not accurate and yet others for both these reasons.

The most popular method has been the hypodermic administration of substances giving a color to the urine. Many dyes have been used for this purpose. The advantage of each dye has dimmed for its virtues not possessed by its predecessors. The latest substance to recruit wide attention is phenolsulphonephthalein. When the results obtained from the use of this drug were reported, it seemed that at last we had a functional test simple and easy of application and accurate in its results.

It was hoped that some article on the subject would state the minimum percentage output which would be safe for surgical operation. Such information to the best of my knowledge has not appeared nor have I been able to obtain definite data on this point from one who had experience with the test.

Charles Goodman has reported a death from uremia following a suprapubic cystostomy under local anesthesia for complete retention of urine due to an enlarged prostate. The phthalein output was 27 per cent. Wm. F. Braach has mentioned cases subjected to operation in which the phthalein output was below 15 per cent and the patients made good recoveries. Rowntree, Geraghty and Marshall have reported a case of prostatectomy in which the phthalein output was 8 per cent; the patient recovered.

One evening, after listening to a very interesting and impressive discussion on this test by Doctor Rowntree, I inquired what he considered the minimum percentage output which would be safe to undertake operations. His reply was, "The greater the output the less the risk. I could not obtain from him definite information on this point. I then decided to use the test as a routine procedure to ascertain, if possible, what would be the minimum percentage output to safely undertake surgical operations, and to determine if the test would be of value to the surgeon in his routine work.

I have employed the test in about three hundred cases—not consecutive cases, as that was not possible. I took them as they came with absolutely no selection. While employing the test in the routine work, I paid absolutely no attention to the reports in the selection of cases for operation but decided on other data previously used. The material for this paper is based on the observations of the first one hundred cases, on which one hundred twenty tests were made and the total output represents the percentage excreted in two hours.

When injected deep in the lumbar region, the time in which the phenolsulphonephthalein appeared in the urine varied from five minutes to forty-two minutes, the average being ten minutes and eighteen seconds, or approximately ten minutes.

The output in the case in which the dye appeared in forty-two minutes was approximately only 2 per cent less than the average output for the series. Three tests were made on this patient. In the first test the dye appeared in twenty-five minutes and the output was 37 per cent. The next day the test was repeated; the dye appeared in forty-two minutes and the output was 33 per cent. Twenty-four days later the test was again applied and the dye appeared in eleven minutes, the output being 55 per cent. The

last test was made after the patient had recovered from an acute pelvic peritonitis.

The output varied from 21 per cent to 96.5 per cent. The average output in the series for the first hour was 34.27 per cent, for the second hour 20.83 per cent, and for the two hours 55.1 per cent.

In ten or 8.3 per cent of the tests the percentage output was greater in the second hour. In 20 per cent of the total tests made in this series, 4 per cent or less than 4 per cent was the difference between the output for the first and second hour.

In this series five cases with approximately 25 per cent output were subjected to major operations.

CASE 1. The patient, age 36, was suffering with right pyonephrosis. When admitted to the hospital the phthalein output was 28 per cent. Four days later the output was 21 per cent. The following day the right kidney, which was palpable and the upper two calyces of the pelvis removed. The patient died nine hours after the operation. The phthalein output was 5.4 per cent. Eight days after the operation the phthalein output was 1 per cent. Four months before this operation the patient had been removed from the left kidney, which was palpable. The phthalein test before the operation was 11 per cent. The patient died three days after the operation.

CASE 2. Mrs. L., age 48, had a right pyonephrosis. She was admitted to the hospital. The phthalein output was 5 per cent. The patient died following morning after the operation.

The stone was removed by a suprapubic cystotomy. The patient had a usually easy convalescence.

These five cases had the smallest percentage of phthalein output in the series. All were considered good surgical risks, all had an easy convalescence with no evidence of renal disturbance. In this connection it is interesting to compare the results in a series of a low percentage output with a series of a higher percentage output.

CASE 3. Mrs. H., age 55, was subjected to operation for malignancy of ovary. When admitted to the hospital the phthalein output was 66 per cent. The patient died at home. The quantity of urine secreted was small and contained albumin and sugar.

CASE 4. Mrs. L., age 46, was sent to the hospital for radical operation for carcinoma of the cervix uteri. The phthalein output was 53 per cent. She was considered a high surgical risk and died of pneumonia only a few days after the operation. She died of pneumonia less than one month.

CASE 5. Mrs. B., age 40, was sent to the hospital for operation for removal of the cervix uteri. The phthalein output was 48 per cent. She was considered a high surgical risk and died of pneumonia only a few days after the operation. She died of pneumonia less than one month.

CASE 6. Mrs. H., age 42, was admitted to the hospital for operation for removal of the uterus. The phthalein output on admission was 48 per cent. Although there was no operation, the patient died of pneumonia only a few days after the operation. She died of pneumonia less than one month.

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The most popular method has been the hypodermic administration of substances giving a color to the urine. Many dyes have been used for this purpose. The advantage of each dye has limited for its virtues not possessed by its predecessors. The first substance to receive wide attention was phenol-sulphone-phthalein. When the results obtained from the use of this drug were reported it seemed that at last we had a functional test simple and easy of application and accurate in its results.

It was hoped that some article on the subject would take the minimum percentage output which would be safe for surgical operations. Such information is the best of my knowledge has not appeared nor have I been able to obtain behind data on this point from one who had experience with the test.

Charles Goodman has reported a death from uremia following a suprapubic cystostomy under local anesthesia for complete retention of urine due to an enlarged prostate. The phthalein output was 27 per cent. Wm. I. Brash has mentioned cases subjected to operation in which the phthalein output was below 15 per cent and the patients made good recoveries. Rowntree, Caraghty and Marshall have reported a case of prostatectomy in which the phthalein output was 8 per cent the patient recovered.

One evening after listening to a very interesting and impressive discussion on this test by Doctor Rowntree I inquired what he considered the minimum percentage output which would be safe to undertake operation. His reply was "The greater the output the less the risk" nor could I obtain from him definite information on this point. I then decided to use the test as a routine procedure to ascertain if possible what would be the minimum percentage output to safely undertake surgical operation and to determine if the test would be of value to the surgeon in his routine work.

I have employed the test in about three hundred cases—not consecutive cases, so that was not possible. I took them as they came with absolutely no selection. While employing the test in the routine work, I paid absolutely no attention to the reports in the selection of cases for operation but decided on other data previously used. The material for this paper is based on the observation of the first one hundred cases on which one hundred twenty tests were made and the total output represents the percentage excreted in two hours.

When injected deep in the lumbar region, the time in which the phenol-sulphone-phthalein appeared in the urine varied from five minutes to forty-two minutes, the average being ten minutes and eighteen seconds, or approximately 13 minutes.

The output in the case in which the dye appeared in forty-two minutes was approximately only 2 per cent less than the average output for the series. Three tests were made on this patient. In the first test the dye appeared in twenty-five minutes and the output was 37 per cent. The next day the test was repeated the dye appeared in forty-two minutes and the output was 53 per cent. Twenty-four days later the test was again applied and the dye appeared in eleven minutes, the output being 55 per cent. The

last test was made after the patient had recovered from an acute pelvic peritonitis.

The output varied from 21 per cent to 96.5 per cent. The average output in the series for the first hour was 34.27 per cent, for the second hour 20.83 per cent and for the two hours 55.1 per cent.

In ten or 83 per cent of the tests, the percentage output was greater in the second hour. In 20 per cent of the total tests made in this series, 4 per cent or less than 4 per cent was the difference between the output for the first and second hour.

In this series five cases with approximately 25 per cent output were subjected to major operations.

**CASE 1.** The patient, age 36, was suffering with a night pyrexia. When admitted to the hospital the phthalein output was per cent. Four days later the output was 75 per cent. The following day the right kidney which was palpable and the pyrexia ceased. The patient recovered. Ten days after the operation the phthalein output was 35 per cent. Eighteen days after the operation the phthalein output was 3 per cent. Five months before this admission the patient had been removed from the left kidney and ureter. If the phthalein test be applied at that time the output could have been as there was no ureter. The patient made a good recovery.

**CASE 2.** Mrs. P., age 48, had acute pyelitis. When admitted to the hospital the phthalein output was 23 per cent. The pyelitis removed the following morning and the patient made a good recovery.

**CASE 3.** Mrs. G., age 3, was admitted to the hospital with diagnosis of laceration of the uterus and of the perineum, cystocele and lateral malposition of the uterus. The phthalein output was 5 per cent. A dilatation and curettage of the uterus, a tenor colporrhaphy, a perineorrhaphy and bilateral salpingectomy were performed. The patient had normal output after the operation.

**CASE 4.** Mrs. B., age 4, was admitted to the hospital with diagnosis of liver abscess, pyelitis and the perineum and bilateral malposition. The phthalein output was 24 per cent. The patient was subjected to operation for repair of the liver abscess and removal of the biliary ducts. She had normal output after the operation.

**CASE 5.** Mrs. S., age 6, complained of discomfort in the pelvis and of some irritation of the bladder. She had had two operations on the anterior and posterior vaginal walls with little relief from the discomfort. Cystoscopic examination revealed a large cervical calculus. When admitted to the hospital the phthalein output was 75 per cent.

The stone was removed by a suprapubic cystostomy. The patient had an unusually easy convalescence.

These five cases had the smallest percentage of phthalein output in the series. All were considered good surgical risks, all had an easy convalescence with no evidence of renal disturbance. In this connection, it is interesting to compare the results in a series of a low percentage output with a series of a higher percentage output.

**CASE 34.** Mrs. H., age 52, was subjected to operation for a malignant ovarian cyst. When admitted to the hospital the phthalein output was 66 per cent. The patient had a stormy convalescence. The quantity of urine excreted was small and contained albumin and many casts.

**CASE 35.** Mrs. L., age 46, was sent to the hospital for a radical operation for carcinoma of the cervix uteri. The phthalein output was 53 per cent. She was considered a bad surgical risk, and curettage and cauterization only were done. She died of uraemia less than two months.

**CASE 36.** Mrs. B., age 40, was sent to the hospital for operation for carcinoma of the cervix uteri. The phthalein output was 72 per cent. She was considered a bad surgical risk, and a curettage of the cervix only was made. She died of uraemia in less than one month.

**CASE 37.** Mrs. B., age 40, was admitted to the hospital for curettage of the uterus. Microscopic examination of the tissue removed by the curettage showed the lesion to be a carcinoma of the corpus uteri. The phthalein output on admission was 54 per cent. Although there was no apparent invasion of the malignant process beyond the uterus, this patient was considered a doubtful surgical risk.

We decided, however, to give her the benefit of a complete hysterectomy, the patient being on the day after operation the normal amount of urine was excreted. The quantity began to diminish on the fourth day and there was no well marked evidence of uraemia. At this time the phthalein output was 9 per cent. The patient remained in a state of mild acidosis, of well marked coma until the fifty-second day after operation, at which time she passed away.

**CASE 38.** Mrs. J., age 3, was admitted to the hospital because of marked toxæmia of pregnancy. The amount of urine passed in twenty-four hours was about 55 ccm and contained a large quantity of albumin, granules and hyaline casts. The patient was marked with the face and ankles swollen. The phthalein output was 10 per cent. It was decided to try her on bed rest and appropriate treatment before terminating the pregnancy. Ten days later the quantity of urine had increased, containing decidedly less than normal.

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I have employed the test in about three hundred cases—not consecutive cases, as that was not possible. I took them as they came with absolutely no selection. While employing the test in the routine work, I paid absolutely no attention to the reports in the selection of cases for operation but decided on other data previously used. The material for this paper is based on the observations of the first one hundred cases, of which one hundred twenty tests were made and the total output represents the percentage excreted in two hours.

When injected deep in the lumbar region, the time in which the phenol-sulphonephthalein appeared in the urine varied from five minutes to forty-two minutes, the average being ten minutes and eighteen seconds, or approximately ten minutes.

The output in the case in which the dye appeared in forty-two minutes was approximately only 2 per cent less than the average output for the series. Three tests were made on this patient. In the first test the dye appeared in twenty-five minutes and the output was 37 per cent. The next day the test was repeated, the dye appeared in forty-two minutes and the output was 53 per cent. Twenty-four days later the test was again applied and the dye appeared in eleven minutes, the output being 55 per cent. The

<sup>1</sup> Ann. St. Ann. 1912, Vol. 24.

<sup>2</sup> Ann. St. Ann. 1912, Vol. 24.

Burg, Cyster & Child. 1912, 1913, 1914.

Name and Date	Age	Time of Appearance	Percentage Output First Hour	Percentage Output Second Hour	Total Percentage Output	Diagnosis	Remarks
15 Mrs. O 10/12/ 20/12/	31	20	41	27	68	Location of C and P retro stria	
16 Mrs. P 12/12/	43			11	3	Acute appendicitis	No renal complications following operation
17 Mrs. H 14/12/	26	7	26	10	36	Location of C and P cystoids	
18 Mrs. M. E. 15/12/	40		22	20	42	Decidual ulcer	
19 Mrs. S 20/12/12	33	8	1			Cholelithiasis	
20 Mrs. O 20/12/1	15	10	10	20	30	Retained secretions	
21 Mrs. T 20/12/12	17	12	11	20	42	Pregnancy	Just to hospital with diagnosis of ovarian cyst
M. V. 20/12/	23		26	26	52	Bilateral pyelitis and ap- pendicitis	
22 Mrs. O 21/12/1	26			15	43	Location of C and P retro stria movable right kidney	
23 Mrs. A 20/12/1	41		22	14	36	Chronic appendicitis condense color renal disease	Much improved by treatment and test is bad, while percentage output was low. Patient much better when seen eight months later
24 Mrs. L. 11/12/	60	20	26		46	Location of C and P cystoids	
25 Mrs. H 11/12/	54	6	34	18	52	Enterovira also intestinal adhesion	
26 Mrs. D 11/12/13	30		40	20	60	Ectopic gestation with infected hematocoele	
27 Mrs. O 1/12/	20		40	20	60	Fibrosarcoma thia	
28 Mrs. O 11/12/12	27	12		20		Location of C and P cystoids bilateral appendicitis sigmoid	Latent renal insufficiency
29 Mrs. E 10/12/12 12/12/1	30		20	20	40	Bilateral pyelitis, retro stria condense intestinal adhesion retro pyelitis	
30 Mrs. B 12/12/	32		20	20	40	Cholelithiasis renal disease, tubercular fibrosis and stria	High pressure type men of glaucoma
31 M. B. 12/12/1	35	10	14	10	34	Location of C and P by development	Normal coarctation
32 M. D. 12/12/1	24	5	24		29	Intestinal adhesion following appendicectomy	
33 Mrs. D 12/12/12	30		43	33	76	Movable right kidney down to level of pelvis	
Mrs. M. 12/12/1	21	8		44	52	Extrastoma	
34 Mrs. B 12/12/	60			33	36	Ovarian cyst, pyelitis, men pulmonary and laryngeal tuberculosis	
35 Mrs. M. 12/12/	13		25	23	48	Chronic appendicitis gross renal vagrants	
36 Mrs. B 12/12/	20	8	20	24	44	Chronic appendicitis gross renal vagrants	
37 M. B. 12/12/	25	6	20	42	68	Cholelithiasis sigmoid fibrosarcoma, stria, chronic appendicitis	
38 Mrs. M. 12/12/	26		20	20	40	Purulent infection	Recurrent

Case No. / Date	Age	Time of Appearance	Percentage Output First Year	Percentage Output Second Year	Total Percentage Output	Diagnosis	Remarks
27 M. O 7/6/11	53	6	40	53	61	Chronic appendicitis - adhesion between left ovary and sigmoid	
28 M. E. 7/6/11	1		45	51	68	Enlarged ovaries	
29 M. M. 7/11/11	55		34	53	39	Abdominal pain	
34 Mrs. B. 1/14/12	54		30	30	66	Malignant ovarian cyst	Period small quantity of menses after operation - many cysts.
37 Mrs. O. 1/16/12	46	10	30	30	70	Laceration of C and P	One month's rest after an abdominal output was 30 per cent.
38 M. L. 1/16/12	46		31	33	33	Carcinoma of cervix uteri	Death of uterine in less than two months
37 Mrs. B. 1/14/12	41		23	19	31	Laceration of C and P - sub mucosa fibromyoma noted	
38 Mrs. B. 1/14/12	30		12	37	76	Laceration of C and P - Per for appendicitis (chronic ap- pendicitis)	
39 Mrs. B. 1/14/12	40		30		74	Carcinoma of cervix uteri	Death of uterine in less than one month.
40 Mrs. O. 1/14/12	30		23	14	37	Mammary right kidney	
41 Mrs. H. 1/14/12	41	30	30	33	67 1/2	Cystitis and proctitis	
44 Mrs. B. 1/14/12	31	30	40		67	Prolonged ovary	
45 Mrs. J. 7/7/12	34		30	37	67	Laceration of P - cystitis and proctitis	
46 Mrs. E. 1/14/12	64	6	30	5	61	Gastritis	
47 Mrs. O. 2/7/12	40	30	7	14	23	Fluororrhoea uteri	
48 Mrs. J. 7/16/12	35	8	11	8	30	Ovarian cyst	
47 M. C. 2/1/12	39	14	35	36	31	Laceration of C and P - pro- pion - chronic appendicitis	
48 Mrs. O. 2/1/12	35		31		37	Laceration of C and P - pro- pion	
49 Mrs. B. 2/1/12 2/16/12	40		31 30 24	8 13 24	33 33 38	Fluororrhoea uteri carcinoma cervix uteri	After treatment the patient was extremely low - began vomit spontaneously. Within three days she was 30 per cent. in 24 hours and there was mild cramp. The abdominal output was 30 per cent.
50 M. M. 2/1/12	32	26	37	37	34	Carcinoma of cervix uteri	
51 Mrs. B. 1/14/12	36	30	18	36	34	Left salpingitis - chronic ap- pendicitis	
52 Mrs. M. 2/1/12	43		35	37	43	Laceration of C and P - ma- mmary kidney	
53 M. 2/13/12	36	20	34	6	66	Proctitis with acute pro- ctitis	
54 Mrs. B. 2/13/12	37	6	24	24	74	Chronic appendicitis	
55 Mrs. B. 2/13/12	64		12		37 1/2	Vaginal calculus	
56 M. C. 7/12/12	40	13	30	30	30	Acute myeloid leucemia	

Name and Date	Age	Time of Appearance	Percentage Output First Hour	Percentage Output Second Hour	Total Percentage Output	Diagnosis	Remarks
77 Mr M 2/ /	26		63	1	64	Laceration of C and P, cystic ovary, pelvic adhesions, chronic appendicitis	
78 Mrs A 2/21/			30	31	70	Laceration of C and P, chronic appendicitis	
79 Mr J 4/ / 4/ 2/ / 4/ 4/12	23	30	36 12 40	30 42 1/2	66 60 1/2 63	Hydatidiform mole, serosal lesion	Large quantities of albumen, many casts. Swelling of face and limbs. Loss of vision in one eye and decided impairment in other eye
80 Mrs W 2/21/12	28		60	16	76	Ruptured vermiform	
81 Mrs D 2/21/	24	9	34		60	Pyosalpinx	
82 Mr H /12	21	3	27		44 1/2	Acute appendicitis	
83 Mr W 4/ /14	43		23	21	44	Perforated appendix	
84 Mrs C 4/ /	26		27	26	53	Laceration of C and P	
85 Mrs L 4/ 2/12	43	1	16	16	32	Laceration of C and P, cystic ovary, chronic appendicitis	
86 Mrs K 4/ 3/	23		44		57	Dorsal cyst of ovarum, retro, chronic appendicitis	
87 Mrs D 4/ 2/12	30		70		55	Chronic arthritis of right ankle	Referred to surgical department
88 Mrs 4/29/12	40			20	20	Irreducible peritoneal hernia, laceration of C and P	
89 Mrs K /29/12	24		30	24	54 1/2	Complete laceration of peritoneum	
90 Mrs W 2/ 2/12	30		44	17	60	Intestinal hernia	
91 Mrs E S 2/ /12 2/ 1/12 2/ 1/12	30		64 60 16	20 20 16	63 60 36	Nasal calculus	Calculus was passed 2/ / 3
92 Mrs McK 1/ 2/ / 2/ 2/ /	64	1	62 43	22 8	64 61	Thrombocytopenia state	Urine specific gravity .970 At times trace of albumen Glucose per cent 10 per cent. Blood pressure on all occasions 200 mm. of mercury after rest in bed. Few days fell to 120 mm. mercury. Unimpaired good surgical risk. Hysteroecomy 2/7/12 Convalescence unusually easy
93 Mr H 2/ 2/12	48			20	46	Metrorrhagia, laceration of C and P	
94 Mrs M 2/ 1/ /	23		40	20	60	Laceration of C and P, retro, when rebounding appendicitis	
95 Mrs / 2/12	20				61	Laceration of C and P, retro, when chronic appendicitis	
96 Mrs R 2/29/12	40	14	43	20	63	Acute appendicitis	
97 Mrs J 2/12/	26				27	Laceration of C and P, retro, when chronic appendicitis	
98 Mr P 2/17/12	26		53	34	87	Concomitant abdominal	Died of renal insufficiency five days after operation
99 Mrs McG 2/ /	23		44		54	Flare-up of hernia	
100 Mrs S 2/ /	27	1	26	1 1/2	78	Acute appendicitis	

Name and Date	Age	Time of Appearance	Percentage Output First Hour	Percentage Output Second Hour	Total Percentage Output	Diagnosis	Remarks
70 Mrs G 1/4/11	31	8	41	63	64	Chronic cystitis, infection but no abscess and no spread	
71 Mrs K 1/4/11	31		42	53	65	Retained placenta	
72 Mrs W 1/4/11	30	11	36	53	70	Abdominal pain	
73 Mrs B 1/5/11	34		36	34	66	Malignant ovarian cyst	Found small quantity of stone when examining empty cyst
74 Mrs O 1/6/11	34	10	30	56	76	Lacerations of C and P	One stomach ulcer when on admission output was 30 per cent.
75 Mr L 1/6/11	46			51	51	Carcinoma of cervix uteri	Dead of infection as less than two months
76 Mrs B 1/6/11		9	33	36	55	Lacerations of C and P, high anterior (Bleeding from cervix)	
77 Mr W 1/6/11	30		33	51	75	Lacerations of C and P, first and second degree, chronic appendicitis	
78 Mrs B 1/6/11	40		30	53	73	Carcinoma of cervix uteri	Dead of infection as less than one month
79 Mrs G 1/12/11	40		33	5	34	Morbidly ruptured ovary	
80 Mrs H 2/1/12	42	10 10		46 46	51 51	Cystitis and abscess	
81 Mrs H 2/1/12	30	10	30		31	Perforated ovary	
82 Mrs J 2/1/12	33	7	40	27	55	Lacerations of P, cystitis and abscess	
83 Mr Y 1/1/12	61	5	40	59	51	Gastritis	
84 Mrs G 2/1/12	40	14	47	50	57	Pharyngitis uteri	
85 Mrs J 1/12/12	35	5	41	5	46	Ovarian cyst	
86 Mrs C 2/1/12	40	14	46	57	57	Lacerations of C and P, cervix uteri, chronic appendicitis	
87 Mrs G 3/1/12	35		41	51	50	Lacerations of C and P, cervix uteri	
88 Mrs B 2/1/12 3/2/12 3/10/12	40	11	37 38 34	46 43 44	35 39 36	Pharyngitis uteri, carcinoma cervix uteri	After operation the patient was extremely low, blood count satisfactory. When ready was dead on job done at 24 hours and there was mild pain. The job before output was 25 per cent.
89 Mrs W 2/1/12	31	10	33	33	34	Carcinoma of cervix uteri	
90 Mrs B 2/1/12	40	10	33	36	34	Left salpingitis, chronic appendicitis	
91 Mrs M 2/1/12	38		35	37 37	46	Lacerations of C and P, high side lacerations	
92 Mrs B 2/1/12	46	10	37	36	46	Pyosalpinx with acute pain	
93 Mrs B 2/1/12		6	44	34	36	Chronic appendicitis	
94 Mrs B 2/1/12	41	11	37 37	34	37	1 small colitis	
95 Mrs C 2/1/12	46	11	40	36	40	Acute appendicitis except post mortem	

of the abdomen often in the right iliac fossa. Hyperesthesia is many times characteristic. At times a dilated cecum may be palpated, there may be gurgling on palpation of this region. The main point of tenderness may be in the region of the gall bladder the kidney or the sigmoid.

With the exception of the above the objective symptoms may be characteristically and suspiciously negative. The X ray may corroborate the very apparent clinical fact of delay in progress of the intestinal contents.

**Etiology.** The chronic abdomen has been attributed to various causes at various times, in the evolution of abdominal surgery. For example Ovarian—neuralgia, cysts adhesions tubal—chronic salpingitis uterine—displacements appendicocal—chronic appendicitis—renal—floating kidney Dietel's crisis biliary—cholecystitis, calculons and non calculous duodenal—ulcer gastric—ulcer cardio or pylorospasm enteroptosis feces—gastric crises.

The term chronic abdomen should be used to apply properly to cases in which the above enumerated conditions may be excluded. Treatment directed toward the cure of the above conditions has many times failed to give permanent relief to patients having more or less of the symptoms that are included under the caption chronic abdomen though they were for a time supposed to be the causative factor. The most recent explanation is the presence of intra abdominal adventitious bands or membranes. Such adventitious bands may be found at various points within the abdomen, such as the terminal ileum (Lane) the ascending colon (pericolic of Jackson) hepatic flexure duodenum and gall bladder (cobwebs in the attic of the abdomen," Morris) splenic flexure and the sigmoid. These abnormal (or abnormal development of normal) bands or membranes may cause various manifestations of obstruction from complete and acute through chronic ileus, to an entire absence of symptoms, despite their marked development and demonstrable presence. The fact that such structures do exist without causing symptoms has given rise to great confusion as to their clinical significance.

In order to arrive at some definite understanding as to the etiological relationship between these bands or membranes and the symptoms complained of it would seem advisable to review as to the remote result a series of cases in which the operative procedure was confined entirely to these structures so that favorable results if secured might not be attributed to the removal or correction of coincidental pathological conditions.

I have therefore considered it worth while to present an analysis of a series of nineteen cases in which appendectomy had been previously performed, without permanent improvement and in which at secondary operations these membranes or bands were found and an attempt made at their correction.

Study of these cases shows the following more or less important details:

Males	4
Females	15
Married	8
Single	
AGE	
Between 6 and 9	3
Between 10 and 20	6
Between 20 and 30	5
Between 40 and 43	5

The previous operation was for—

Interval operation for appendicitis.  
Removal of the appendix during the course of an operation for—

Gastro-enterostomy for pyloric obstruction  
Hysterectomy for fibroid  
Cholecystectomy for calculi  
Removal of ovary  
Resection of ovary, tubal mass ligament shortening  
Shortening of round ligaments  
Removal of appendix and cecostomy  
Removal of appendix with correction of pericolic membrane, sigmoid loop  
Removal of appendix for acute inflammation followed by drainage

More than one operation before the conditions under consideration were corrected

1 real concretions found in the appendix at removal

The time between operations was

1 year	4	3 years
2 years	3	7 years
3 years	3	years
4 years	3	

In only one case was the primary operation performed for acute appendicitis and this patient gave a history of many years of the complaints usually attributed to chronic

the malleoli in some such way that they will hold the a tragus in that position. This can sometimes be done by manipulation and a subsequent plaster swathe or cast but many cases require subcutaneous nailing to hold both sides in position. Where bimalleolar fracture is complicated by rupture of the interosseous ligament and a separation of the lower ends of the two bones with a possible forcing upwards of the a tragus between them nothing short of open operation with the two bones pressed together the astragali returned to it proper articular position and the two malleoli nailed on and the tibia nailed

three weeks. Then the weight may be gradually applied. If painful this is ample evidence that the callus is not yet matured and a further wait is necessary.

At the inception of weight bearing if the external malleolus has been the greatest sufferer in the fracture, the patient should be cautioned to hold the foot straight forward or with toes turned slightly in and the inner side of the heel and sole should be raised slightly. This holds the foot in better weight bearing axis and helps avoid a yielding of the young callus in the fibula and the weakened internal lateral ligament.



Fig 8 A

Fig 8 B

Fig 9 A

Fig 9 B

Figs 8 A and 8 B fracture just above joint. Not posterior deformity in lateral view of foot; no line is given in the front view and never here the mathematical calculation as derived from the front view could lead one into serious error. Figs 9 A and 9 B Repair by opera-

tion and insertion of right-angled steel plate of fracture shown in Fig 8. Tibia brought into alignment and also cut into upper and lower fragments into which the right angled plate is inserted, and then screws driven so to hold position. This makes very firm support on both planes. Clap in skin.

to the tibia will preserve good function and prevent the wide painful ankle. After such operation or happy mechanical reduction in bimalleolar fracture the foot should not be put up in adduction, but should rest at a right angle and be allowed a long immobilization to permit the malleoli to unite firmly with minimum of callus and this callus to mature also to allow the torn ligaments to reunite a process which takes longer than bony union and to establish a normal circulation of rest in the ankle. When the splint is removed very light massage and passive motion may be indulged in but not to a point of pain at any time and no weight-bearing on the foot should be allowed for two or

Besides the mathematical calculation of position of the astragalus, one must take into consideration fracture of the extreme edge or lip of the articular surface of the tibia. By this I mean a splitting off of a wedge like piece, usually of the compact bone along the line of fracture starting at the point and extending upwards along the shaft for a varying distance of one half to two inches or more. These are much like the sprain fractures at the wrist and are caused by a similar mechanism i.e. wedging force upwards by the astragalus which force may be in direct line upwards or at a varying angle and directed toward the anterior, posterior, medial or outer side of the lower end of the tibia.

quids, was less than on admission to the hospital in other cases the output was greater.

Case 91 was one of interest. The patient was admitted to the hospital with a diagnosis of a left renal calculus. A stone was located in the ureter by the catheter and confirmed by the X-ray. The phthalein output on admission was 93 per cent. The patient was confined to bed and given large quantities of water and urinary antiseptics. One week later (and four days before the calculus was passed) the phthalein output was 38 per cent.

Two cases in the series, (41 and 46) with a phthalein output of 52 per cent and 56 per cent respectively, were refused operation as they were considered bad surgical risks and had but little chance of securing even temporary benefit from operation.

#### SUMMARY

The dye appeared in the urine from five minutes to forty two minutes, the average being ten minutes and eighteen seconds.

The average output for the first hour was 34.27 per cent, for the second hour 20.83 per cent, and for the two hours 55.1 per cent.

In 91.7 per cent of the tests the output was greater in the first hour. In 83 per cent of the tests the output was greater in the second hour.

In 20 per cent of the tests there was 4 per cent or less than 4 per cent difference between the output in the first and second hours.

Five cases with the lowest phthalein output in the series, were subjected to major operations and had a normal convalescence.

Other cases with a much higher phthalein output had a complicated convalescence with evidence of renal disturbances.

Case 56 with a phthalein output of 53 per cent, died of uræmia in less than two months.

Case 59 with a phthalein output of 72

per cent, died of uræmia in less than one month.

Case 69 with a phthalein output of 55.5 per cent died in the hospital of uræmia fifty two days after operation.

Case 98 with a phthalein output of 87.5 per cent, died in the hospital of uræmia five days after operation.

In some cases the phthalein output was less after the patients were placed in bed and the excretory organs toned up. In other cases the output increased.

In determining the functional activity of each kidney the test should be applied several times and the average taken. The result should then be checked up by other tests.

#### CONCLUSIONS

It does not seem possible to work out the minimum percentage phthalein output which will be safe to undertake surgical operations, nor is it possible from the phthalein test to determine what cases should or should not be subjected to operation. I believe it will never be possible to determine this point by any laboratory test, as the functional activity of a kidney varies under numerous circumstances and at different times.

In determining whether or not a patient should be subjected to operation the history, clinical symptoms and physical examination are of much greater value than any renal functional test yet devised.

The phthalein test used in conjunction with the clinical symptoms, history and physical examination is of value. A small percentage output should put the surgeon on his guard and cause him to study the patient most carefully before undertaking an operation. The phthalein test should be used only as one of the many methods of investigation in ascertaining the condition of the patient.



of the abdomen, often in the right iliac fossa. Hyperæsthesia is many times characteristic. At times a dilated cæcum may be palpated, there may be gurgling on palpation in this region. The main point of tenderness may be in the region of the gall bladder, the kidney, or the sigmoid.

With the exception of the above subjective symptoms may be characteristically and suspiciously negative. The X-ray may corroborate the very apparent clinical fact of delay in progress of the intestinal content.

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In order to arrive at some definite understanding as to the etiological relationship between these bands or membranes and the symptoms complained of it would seem advisable to review, as to the remote result, a series of cases in which the operative procedure was confined entirely to these structures, so that favorable results if secured might not be attributed to the removal or correction of coincidental pathological conditions.

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Male	4
Females	15
Married	8
Single	
AGE	
Between 6 and 9	1
Between 10 and 20	6
Between 20 and 37	5
Between 40 and 45	5

The previous operation was for—

Internal operation for peritonitis	
Removal of the appendix during the course of operation for	
Cæcocolon erosion for pyloric obstruction	
Ulceration for bleedings	
Cholecystitis for calculi	
Removal of ovary	
Rupture of ovary and removal of ligament	
Removal of appendix and curettage	
Removal of appendix with correction of pericolic membrane and ileal loop	2
Removal of appendix for acute inflammation followed by abscess	
More than one operation before the condition under consideration was corrected	1
Local concretions found in the appendix at removal	3

The time between operations was

3 years	4	5 years	
3 years	3	7 years	
3 years	3	5 years	4
4 years	1		

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## THE CHRONIC ABDOMEN

A REVIEW OF NINETEEN CASES OF PERICOLITIS AND ILEAL KINK IN WHICH THE APPENDIX HAD BEEN PREVIOUSLY REMOVED

BY F. GRIGORY CONNELL, M. D., OMAHA, NEBRASKA

THE term "acute abdomen" has a definite meaning. It is generally used to indicate an abdominal emergency, a crisis, such as perforation, hemorrhage or ileus. The exact cause of the condition may be obscure, but the first step in the treatment and the last in the diagnosis, that is exploratory laparotomy, is plainly called for and effective treatment usually follows this initial step.

The term chronic abdomen is essentially different in many important respects. There is a confusing vagueness about the use and the meaning of the term; the etiology is unknown; the symptomatology varies greatly; treatment is not plain and simple; non-operative has usually failed; laparotomy is not always indicated; and even after abdominal incision the cause of the symptoms may not be apparent. And finally the good result of any attempt at treatment is often only temporary. The acute abdomen calls for mortality tables, while the chronic abdomen calls for morbidity tables.

The chronic abdomen may be characterized by—

A *Pain* abdominal, usually on the right side but may be on the left; may be very definitely localized or quite general; may be constant or periodic; often associated with hyperaesthesia or parasthesia and without an increase in temperature. But the pain rarely demands morphine and is often relieved by recumbency.

B *Intestinal disturbance*. Constipation is usual, but may vary from most obstinate to normal bowel movements, or diarrhoea with colitis. Nausea and distress after eating, commonly spoken of as indigestion or dyspepsia, and gas is common, vomiting rare.

C *General symptoms*. Attributed by Lane and others to an auto-intoxication; by Adams and others to subinfection; are

most characteristic accompaniments of the above pain and intestinal disturbance. They occur in great variety; for example Lane presents the following rather formidable array of maladies or abnormalities, due in his opinion to auto-intoxication:

Loss of appetite, wasting of voluntary muscles, iteration in the texture and color of the skin with pigmentation and often perspiration, subnormal temperature, especially affecting the extremities.

Mental conditions of apathy, stupor or misery, which may become exaggerated; state of melancholia or even apparent imbecility with suicidal tendencies.

There may be neuralgic symptoms, neuritis, frequent headaches, loss of control of the temper, neurasthenia, Rheumatism, polyarthritis, muscle joint, edema. Atrophy of the thyroid gland, either increased or lowered blood pressure, Degenerative changes in the breast. Prolapse of biliary organ (partly because of loss of fat partly because of loss of muscle) increased mobility of the kidney, prolapse, nodules of the uterus. Breathy odors on exhalation at times of sthenic type due to some extent to a distention of the stomach and intestine. Degeneration of the heart muscle, the distention of left heart and aorta and arteriosclerotic changes in the systemic arteries. Renal changes, Bright's disease. Affections of the pancreas, chronic induration, inflammation, not finally cancer. Pancreatic diabetes. Infection of the biliary system, cholecystitis, cholelithiasis, cancer. In many acute and chronic diseases of the liver. Degenerative diseases of the esophagus.

A list almost as long and comprehensive, of indirect results of auto-intoxication or chronic intestinal stasis, is also presented by Lane.

Some of the above only one or many will be found in every case of this character. To me the most strikingly constant and prominent have been the symptoms that may be called nervous. The relation of these symptoms to the main abdominal complaints calls for elucidation on the part of the neurologist. The physical signs are few; there is pain and tenderness in the right side

bedons and of pericolic membrane. *Result* Improvement for a few months, then return of all symptoms.

CASE 2 May 22 191 C D female eighteen years. *Previous peritonitis* Chronic appendicitis. *Interval* One year. *Symptoms during interval* Pain hypersensitive right side of abdomen nausea vomiting constipation loss of weight. *Condition found at second peritonitis* Pericolic membrane enlarged glands ileal kink. *Second peritonitis* Division of bands and membrane, plastic repair. *Result* Temporary improvement.

CASE 3 July 30 09 M C male thirty seven years. *Previous peritonitis* Acute appendicitis drawn in years previous ventral hernia ten years previous. *Symptoms during interval* Right side abdominal cramp morphone gas vomiting constipation loss of weight chronic in bed. *Condition found at second peritonitis* Pericolic membrane ileal kink, caecum dilated atonic no adhesion to it of appendix, omental adhesions to abdominal wound. *Second peritonitis* Division of membrane and band adhesions. Suspension of caecum. *Result* Marked improvement.

CASE 4 February 5 09 I M female sixteen years. *Previous peritonitis* Chronic appendicitis. *Interval* Four years. *Symptoms during interval* Recurrent attacks of right side pain similar to those before operation constipation. *Condition found at second peritonitis* Ileal kink no adhesion. *Second peritonitis* Division of band. *Result* Marked improvement.

CASE 5 January 5 09 S C female twenty years. *Previous peritonitis* Chronic appendicitis. *Interval* Fifteen months. *Symptoms during interval* Improvement for three months then return of symptoms. At present symptoms of acute ileus. *Condition found at second peritonitis* Pericolic membrane, caecum mobile torsion of caecum no adhesion. *Second peritonitis* Division of pericolic membrane suspension of caecum. *Result* Marked improvement.

CASE 6 January 09 D L male forty years. *Previous peritonitis* Chronic appendicitis. *Interval* Ten years. *Symptoms during interval* Constipation pain tenderness and right side abdomen. *Condition found at second peritonitis* Double barrel hotgun colon peritoneal membrane omental type ileal kink. *Second peritonitis* Omental type ileal kink. *Third peritonitis* Division of membrane and band adhesions. *Result* Marked improvement.

CASE 7 February 1910 P J C female thirty years. *Previous peritonitis* Chronic appendicitis. *Interval* Three months. *Symptoms during interval* Tenderness palpable in right iliac fossa constipation nausea and vomiting. *Condition found at second peritonitis* Ileal kink. *Second peritonitis* Division of pericolic membrane no adhesions. *Result* Marked improvement.

Division of membrane caecopexy dilatation of rectum. *Result* Prompt return of symptoms, May.

Fixation of kidney August 13 nephrectomy right. At present similar pain left side, and but little general improvement.

CASE 8 April 20 012 A W female forty eight years. *Previous peritonitis* Chronic appendicitis. *Interval* Fifteen years. *Symptoms during interval* Constipation my fibroma of uterus. *Condition found at second peritonitis* During abdominal hysterectomy found site of appendix free from adhesions. *Second peritonitis* Division of ileal band. *Result* Marked improvement.

CASE 9 June 25 012 Mrs BL forty-one years. *Previous peritonitis* Chronic appendicitis. *Interval* Seven years. *Symptoms during interval* Pain tenderness, nausea, vomiting colic, mass right iliac fossa, constipation extreme. *Condition found at second peritonitis* Localized chronic peritonitis of the terminal four feet of ileum covered by parchment like fibrous tissue forming a ball which first was thought to be malignancy. *Second peritonitis* Separation of adherent ileum September 6, 1913 ileocegostomy. *Interval* October 5 012 enterostomy for acute ileus, June 013 separation of adhesions, enteroenterostomy. *Result* Improvement.

CASE 10 November 7 013 C H female twenty years. *Previous peritonitis* Chronic appendicitis. *Interval* Ten years. *Symptoms during interval* Attacks of right-sided pain in area, vomiting and constipation. *Condition found at second peritonitis* Ileal kink. *Second peritonitis* Separation of ileal band. *Result* Marked improvement.

CASE 11 May 013 M S female thirty-seven years. *Previous peritonitis* Gall stones, peritonitis, pericolic membrane not disturbed. *Interval* November 5 013. *Symptoms during interval* Constipation gastric distress, right-sided pain and tenderness loss of weight melancholia. *Condition found at second peritonitis* Caecum mobile extremely meagre glands pericolic membrane hard become much more thick and leathery double barrelled cecum omentum not adherent to caecum or to appendix. *Second peritonitis* Separation of membrane caecopexy. *Result* Slight improvement.

CASE 12 December 6 13 W B female twenty-seven years. *Previous peritonitis* Chronic appendicitis. *Interval* Ten years. *Symptoms during interval* Pain in right side of abdomen constipation but little pain and tenderness left iliac fossa. *Condition found at second peritonitis* Peritoneal adhesions caecum mobile. *Second peritonitis* Division of peritoneal adhesions. *Result* Marked improvement.

CASE 13 February 013 A N thirty years. *Previous peritonitis* Remission of type double right-sided seven years. *Symptoms during interval* Pain in peritoneum in right iliac fossa. *Second peritonitis* Marked improvement.

appendicitis. Between the operations the history showed acute colic demanding morphine in six, hyperesthesia in nine, vomiting prominent in only four, jaundice in two, melancholia two, menstrual irregularity five, spoken of in the history as being "neurotic," ten constipation absent in two, marked in all others, absent before and present after the first operation, two palpable mass in the the right iliac fossa in seven.

At the second operation the following conditions were encountered:

- Peritoneal membrane, as described by Jackson 4
- Peritoneal membrane thickened
- Peritoneal membrane omental, as described by Flint 5
- Peritoneal membrane anterior mesogastrium, flaccid
- Double bartered colon 6
- Large kink 7
- Circum ischiole 6
- Circum mobile markedly thin, not dilated 3
- Circum mobile markedly thickened
- Acute torsion of the cecum 6
- Enlarged mesenteric glands (not tubercular) 6
- Omentum adherent to old scar 5
- Appendix stump free from adhesions, in every case
- Unusual localized chronic peritonitis of the terminal ileum
- Marked thickening of the peritoneal membrane between first operation (in each of was not disturbed) and the second
- R. formation of peritoneal membrane after its removal 5

At the second operation the following procedures were carried out:

- Division of peritoneal membrane, plastic repair 5
- Division of ileal band, plastic repair 7
- Division of omental adhesions to abdominal wall 5
- Division of perigastric adhesions, plastic repair
- Separation of local adhesions of terminal ileum 7
- Circumcise
- Gastroscopy
- Fixation of hepatic flexure
- Colectomy
- Transgastricostomy
- Anastomoses between transverse colon and sigmoid
- The right ovary was removed in one case, the gall-bladder drained (no stones) in two, curettage in one, and the rectum dated in one.

While considering the question of treatment of this class of cases, it is no more than fair to mention two rather interesting cases that were treated by non-operative measures, and therefore because of the lack of demonstration of the condition may not positively be included in this group. But the clinical history leaves no reasonable doubt as to the similarity to the condition under consideration.

CASE A. Dr. W. male 23, single, clerk. Last operation for chronic appendicitis, prompt relief from symptoms for year, then return of same symptoms, for which an operation for stone in the kidney was performed. N. stone found, but prompt relief for about year after which the same symptoms returned. I then examined him and advised against operation, but the patient went to another surgeon who performed laparotomy and divided some "adhesions on the colon." This was again followed by prompt relief that lasted for about a year. I examined him once more and again advised against operation, and put the patient to bed for a week, gave petrolatum, abdominal massage, and dietary regimen, which was followed by prompt relief which had persisted for six months up to the time of last report.

CASE B. F. 30, single, servant. Operation for chronic appendicitis one and one-half years ago, no relief. Examination revealed a typical neurasthenic, with anorexia, and hyperensitive abdominal scar, both of which disappeared with general improvement under appropriate non-surgical treatment.

The results are as follows. One case is too recent to be considered. Seven cases have been markedly and satisfactorily relieved from the symptoms. Eleven show no improvement. The primary result in all cases was dramatically favorable, but the symptoms began to return after the lapse of variable times, from a month to a year.

One would not be justified in drawing definite conclusions upon a subject so new from cases so few as those in this series. The very common condition of over or hyper excitability in these cases would seem to call for a serious study of the visceral nervous system and neurological consultation before instituting operative procedure. Up to the present the neurologist has been silent upon this subject.

I would emphasize the necessity of awaiting remote results before drawing conclusions, as the immediate result is almost invariably very encouraging and relapses far from uncommon.

CASE J. H. 30, B. I. female, sixteen years. Previous peritonitis. Chronic appendicitis, curettage. Internal three times. Symptoms during attack: Pain, hyperesthesia, right side mass; vomiting, fainting, amenorrhea, constipation, protrusion of right. Condition found at second operation: Omentum adherent to scar, cecum and stump of appendix non-adherent, peritoneal membrane, omental type. Second peritonitis. Division of ad-

SOME CONSIDERATIONS WHICH DETERMINE THE EXTENT OF AN OPERATION IN SEPTIC INVASION OF THE LATERAL SINUS<sup>1</sup>B. HUGH E. JONES, M.R.C.S., L.R.C.P., Liverpool, E.  
*Senior Honorary Surgeon, Liverpool F. and F. Infirmary*

I DO not commence an operation with the fixed idea that the venous channel must be obliterated, its lumen exposed and as far as possible, its walls excised from the torcular herophili to the junction of the jugular vein with the innominate; nor on the other hand do I say to myself "All that is necessary is to plug up the sinus for an inch or two after removing the clot." The conditions found are so varied that the maximum operation may in one case be as futile as the minimum, in another the minor as successful as would have been the major while in a third the maximum operation would appear to give the best if not the only chance of recovery. For this reason also it seems to me that collected statistics are particularly baffling and of little value as a general guide to the extent of the operation required in an individual case. My own experience—contrary I fear to the expectation of the gentleman who have honored me by asking me to read a paper on this subject—is comparatively small (about 30 cases) but if small it has been fairly varied; therefore I propose not to analyze figures, but to give my conclusions as to the best methods of dealing with such conditions as it has been my fortune to recognize. I have also in answer to set questions obtained from twenty-five British otologists practicing outside London expressions of opinion, based on their own experience on varied points of interest. These answers have been tabulated and analyzed, and I have included in the tabulation at the end of this paper the result of this analysis as taken from the actual replies, or the substance of the replies received. Many of these replies are of great interest, and I take this opportunity of publicly thanking those gentlemen who have kindly sent them for the great interest they have shown and the trouble they have taken.

## FACTS WHICH INFLUENCE THE EXTENT OF THE OPERATION BEFORE THE OPERATION IS BEGUN

Let us consider for a moment the anatomical and pathological possibilities of extension of infection or of the actual clot from a given focus. I have recorded a case of metastatic abscess near the shoulder in a simple streptococcal acute otitis media without bone disease or sinus thrombosis. Such cases and cases of temporal bone pyemia without thrombosis of the sinus, do not come strictly within the scope of this discussion but they have to be taken into account because they may present systemic symptoms similar to those of true sinus thrombosis. The rare cases of primary septic thrombosis of the petrosal sinus or a persistent petrosquamosal sinus may also give early pyemic symptoms without at once causing thrombosis of the lateral sinus or bulb. It follows that systemic symptoms with or without labyrinthine disturbances and without any local signs of bone infection should receive the utmost consideration with regard to the necessity for local surgical measures.

Coming to the common mode of infection—cases of the wall of the sulcus lateralis or of the jugular bulb and perisinus abscess—we find that we have in the majority of cases a more regular progression of events, the progress being interrupted at various stations for a shorter or longer period according to the anatomical features, the virulence of the infection and the resisting power of the patient. A perisinus abscess may exist for a considerable period before the wall of the sinus succumbs and may even discharge itself through the fistula formed in the posterior wall of the mastoid without having invaded the sinus. When the sinus wall is penetrated and a clot forms, the process

Dec. 31, 1906.

Read before the Clinical Congress of Surgeons of North America, London, July, 1907.

appendicitis. Between the operations the history showed acute colic demanding morphine in six hyperæsthesia in nine vomiting prominent in only four jaundice in two melancholia, two menstrual irregularity five spoken of in the history as being "neurotic," ten constipation absent in two marked in all others absent before and present after the first operation, two palpable mass in the the right iliac fossa in seven.

At the second operation the following conditions were encountered:

- Percolic membrane, as described by Jackson 4
- Percolic membrane thicker 4
- Percolic membrane oriental, as described by Flint 5
- Percolic membrane anterior mesogastrium, Harris 7
- Double burned colon 6
- Lose knot 6
- Cecum mobile 6
- Cecum mobile sufficiently thin and dilated 6
- Cecum mobile markedly thickened 6
- Acute torsion of the cecum 6
- Enlarged mesenteric glands (not tubercular) 6
- Omentum adherent to old scar 6
- Appendical stump free from adhesions, on every case 6
- Unusual localized chronic peritonitis of the terminal ileum 6
- Marked thickening of the pericolic membrane between first operation (in both it was not disturbed) and the second 6
- Re-formation of pericolic membrane after its removal 6

At the second operation the following procedures were carried out:

- Division of pericolic membrane, plastic repair 7
- Division of anal band, plastic repair 7
- Division of omental adhesions to abdominal wall 7
- Division of mesocolic adhesions, plastic repair 7
- Separation of local divisions of terminal ileum 7
- Carcinoma 7
- Gastroscopy 7
- Fracture of hepatic flexure 7
- Colectomy 7
- Neomemodostomy 7
- Anastomosis between transverse colon and sigmoid 7
- The right ovary as removed in one case, the gall-bladder drained (no stones) in two cases in one and the rectum dilated in one 7

While considering the question of treatment of this class of cases it is no more than fair to mention two rather interesting cases that were treated by non-operative measures, and therefore because of the lack of demonstration of the condition may not positively be included in this group. But the clinical history leaves no reasonable doubt as to the similarity to the condition under consideration.

**CASE A.** Dr W. male, 35 single clerk. First operation for chronic appendicitis prompt relief from symptoms for a year then a return of same symptoms, for which an operation for stone in the kidney was performed. A stone found but prompt relief for about a year after which the same symptoms returned. I then examined him and advised against operation but the patient went to another surgeon who performed laparotomy and divided some adhesions on the colon. This was again followed by prompt relief that lasted for about a year. I examined him once more and again advised against operation, and put the patient to bed for week gave petrolatum abdominal massage and dietary regimen which was followed by prompt relief which had persisted for six months up to the time of last report.

**CASE B.** F., 30 single, servant. Operation for chronic appendicitis, one and one half years ago no relief. Examination revealed typical neurosthenia, with aerophagia, and hypersensitive abdominal wall both of which disappeared with general improvement under appropriate non-surgical treatment.

The results are as follows. One case is too recent to be considered seven cases have been markedly and satisfactorily relieved from the symptoms eleven show no improvement. The primary result in all cases was dramatically favorable but the symptoms began to return after the lapse of variable times, from a month to a year.

One would not be justified in drawing definite conclusions upon a subject so new from cases so few as those in this series. The very common condition of over or hyper excitability in these cases would seem to call for a serious study of the visceral nervous system and neurological consultation before instituting operative procedure. Up to the present the neurologist has been silent upon this subject.

I would emphasize the necessity of waiting remote results before drawing conclusions, as the immediate result is almost invariably very encouraging and relapses far from uncommon.

**CASE C.** June 3, 1909. B. L. female 30 years. Previous operation Chronic appendicitis curettage. I treated three years. Symptoms during interval Pain hypersensitive right side women missing fainting amenorrhoea constipation neurotic loss of weight. Colon found at second operation Omentum adherent to scar cecum and stump of appendix non-adherent pericolic membrane oriental type. Second peritonitis. Division of ad-

pending on the position of the foot at the time of the trauma and the additional pulling tearing out stress of the capsular ligament tibiofibular posterior ligament on the bone surface. These I have frequently observed in the last three years and have applied to them the term "hipping fractures." If these fragments are not replaced although the astragalus may be situated quite perfectly anatomically and the fracture of either malleolus be but a mere split a great interference in function results. This is explained by the fact that callus is thrown out under the misplaced shell of bone shoved down in front of the ankle joint at some quarter of its circumference

put up in the proper position to meet the demand of the case. I find this condition mentioned by Robert Jones and his whole word on the subject can be profitably quoted.

I have frequently seen a wedge of bone knocked off the anterior and outer part of the lower end of the tibia. This may occur by itself or as a complication of a Pott's fracture. The detached fragment is liable to slip down a little and block dorsiflexion and therefore interfere with walking. The treatment in the first instance is to get the foot into extreme dorsiflexion, thus pushing the fragment out of the way. If the foot is fixed in this position for a few days the condition will not recur.



Fig. A

Fig. B

Fig. C

Fig. D

Figs. A and B A bursting forward of the anterior edge of the tibia. Hip fracture. The tibiofibular joint gives no information of the serious condition.

Fig. C Complete fracture of internal malleolus. loose Astragalus pushed outwards a little.

ence which later by its presence and possible adherence to capsular ligament or the astragalus causes marked interference with full flexion or extension of the ankle joint and provokes much pain after use of the joint by mechanically impinging against the astragalus. Such ankles may show perfect alignment of malleoli and astragalus and yet be extremely painful after mild use. These hip fracture fragments should be searched for carefully both clinically and in the skigram and replaced by hyperextension or hyperflexion at the time the fracture is set. If they cannot be reduced by manipulation I believe they should be nailed on in correct position through a small skin opening after which if malleolar fracture is present the foot can be

In old standing cases, the patient comes with a history of an injury to the ankle or of a fracture in that region and complains of pain over the front of the ankle joint. On inspection the foot seems rather fuller than its fellow in the region. The X-ray photograph shows some irregularity of outline chiefly due to irritation periostitis. The treatment is to operate removing the offending portion of bone and making sure that the foot can be completely dorsiflexed. If the patient declines operation then the only thing to be done is to raise the heel of the boot so that the front of the astragalus does not impinge on the front of the tibia when walking.

This study shows that displacement of the

*dition found at second operation* Mid line ptosis, pericolic membrane mesenteric glands, omental adhesions to abdominal wall, caput caecum free from adhesions. *Second operation* on Coffey hamood operation, fixation of the caecum December 10, 1913 colectomy leopoldostomy. *Result* Considerable improvement with gain of fifteen pounds for five months then return of all symptoms.

**CASE 4** January 16, 1913. C. H. J. female, forty years. *Previous operation* Plastic resection of right ovary appendectomy short round ligaments. *Interval* Four years. *Symptoms during interval* Right side at 17½ painful tender gra, constipation coming absent. *Condition found at second operation* N adhesions of ovary or caput caecum. Caecum dilated and markedly movable. Double barrelled colon, omental pericolic membrane directly continuous with fundus of gall bladder typical of condition described by Harris (J. Am. M. Ass. April 9, 1914). *Second operation* Divided membrane and extension of gall bladder. Fixation of caecum. Removed right tube and ovary. *Result* No improvement.

**CASE 25** February 5, 1914. A. D. female twenty-seven years. *Previous operation* Appendectomy curettage. *Interval* 7 years. *Symptoms during interval* Pain, tenderness right side, mass in iliac fossa gra constipation frequent and painful. *Condition found at second operation* Sit of appendix non adherent, marked caecum mobile dilated, thickened wall, leather like pericolic membrane. *Second operation* Division of pericolic membrane. *Result* Temporary improvement for four months then return of original complaint.

**CASE 6** March 6, 1914. A. S. female twenty-seven years. *Previous operation* Chronic appendicitis. *Interval* Seven years. *Symptoms during interval* Right-sided colics, diagnosed as bilious. *Condition found at second operation* Omentum adherent to abdominal wall. Appendix stump free from adhesions. Omental pericolic membrane. Hepatic flexure bent. *Second operation* Division of adhesions and of pericolic membrane. *Result* Five days after operation symptoms of brain tu-

mor diagnosed polio encephalitis. Abdomen negative for two months, then return of same attacks. *Diagnosis*, hysteria.

**CASE 17** January 5, 1914. Mrs. S. female, thirty-three years. *Previous operation* Chronic appendicitis, round ligament shortening. *Interval* T and one half years. *Symptoms during interval* Pain tenderness right and left lower abdomen leucorrhoea palpable mass, right side gastric distress, constipation. *Condition found at second operation* Sigmoid adherent to left broad ligament no mental adhesions double barrelled colon omental pericolic membrane caecum mobile dilated, and thickened. *Second operation* Division of adhesions and of pericolic membrane. *Result* No improvement.

**CASE 8** March 6, 1914. V. F. male, twenty-nine years. *Previous operation* Chronic appendicitis, ileal kink, pericolic membrane thick, October 1, 1903. *Symptoms during interval* Right-sided colic, severe, nausea, vomiting constipation, which was absent before operation jaundice. *Condition found at second operation* Omentum adherent to abdominal wall as of appendix end caput caecum free a new pericolic membrane thinner and vascular had formed omentum attached to gall bladder and hepatic flexure mesenteric glands terminal ileum attached to anterolateral abdominal wall. *Second operation* Separation of adhesions and membrane cholecystostomy, no stones. *Result* No improvement.

**CASE 19** April 3, 1914. M. D. male, age 48. *Previous operation* Gastro-enterostomy 1903 second gastro enterostomy for jejunal ulcer 1907 resection of pylorus gastro enterostomy appendectomy microscle ileal kink March 1914. *Symptoms during interval* Constipation attacks of pain, right side nausea vomiting mass in right iliac fossa exaggerated peristalsis. *Condition found at second operation* Obstruction of transcolon with dilated transverse colon in right iliac fossa. Omentum adherent to abdominal wall none to caecum. No entrance of ileal kink. *Second operation* Anastomosis between transverse colon and sigmoid. *Result* Too early.

dents altered their practice with regard to ligation of the vein because they believed that ligation had caused immediate invasion of the cavernous sinus.

My own opinion is that a septic infection of the cavernous sinus will not readily arise without interference because of the narrowness of the superior petrosal sinus and its proximal situation in relation to the focus of infection and because the inferior petrosal sinus is largely protected by its valvular entrance into the lower end of the bulb. At the upper end of the vein this valvular entrance however is no protection against a return flow of septic blood from the vein or from irrigation from vein to sinus. The vein if tied, should therefore be also excised or opened at once (after occlusion of the proximal end of the sinus) when the contents are more or less fluid and if irrigated the process should be carried out from sinus to vein.

The much discussed anatomical variation whereby one lateral sinus is made to do nearly all the work of two claims some consideration. None of my correspondents has referred to the matter and I have no personal experience of this variation. In the case referred to above in which both sinuses were completely occluded, there was great engorgement of the veins of the scalp and a congenital sinus had formed around the mastoid vein on the side originally diseased. As this patient died from temporal sphenoidal abscess of the opposite side and toxæmia, I have no reason to suppose that the circulatory difficulty could not have been overcome. Whithead's case quoted above also proves that the circulation may be reestablished. The occurrence of a rudimentary sinus on one side is admittedly rare. Lister puts it at three per cent and there can be no doubt that by the time the necessity for ligation of the internal jugular vein arises, especially in sinus thrombosis, compensatory collateral circulation has been to some extent established. *When the need for ligation is a real one the risk of ligation must be taken, but if possible the facial and external jugular veins should always be spared.*

#### COMPLETION OF THE DIAGNOSIS DURING THE COURSE OF THE OPERATION

The first necessity in treatment is a complete diagnosis before or during the early stages of the operation so that all that is necessary to be done may be accomplished at the time without recourse to a second operation. This of course is not always possible but it is the thing to aim at. As has often been said the existence of a thrombus does not in itself cause systemic symptoms; in fact, it may prevent them. On the other hand general pyæmic symptoms in themselves do not prove the existence of a thrombus nor do swelling and pain in the neck. It is necessary therefore in nearly all cases to expose the sinus at the first (or counting the mastoid operation as the first stage at the second) stage of the operation. The only admissible exception to this rule appears to be when the disease has existed for several days lung metastases are present and rigors are frequent. In such a case the clot is probably in a state of disintegration and a rapid exposure, ligation and opening of the vein may save valuable time. Having thoroughly cleared out the mastoid and opened the groove of the sigmoid sinus and finding there a purulent abscess with granulations covering the sinus or any departure from the normal appearance of the sinus bone should be removed in both directions without disturbing or even touching the sinus more than is absolutely necessary until at least half an inch of healthy wall is exposed if possible at both ends of the diseased area. Several of my correspondents say that there are no reliable indications of the condition of the intima or of the character of the contents of the sinus prior to an exploratory incision or aspiration. With this I cannot agree. My experience is that healthy granulations and pus in the absence of a history of repeated rigors vomiting and oscillating temperature indicate a sound intima and fluid blood. The absence of granulations over any part of a sinus which has not the healthy bluish white semi-translucent normal appearance indicates infection of the intima and either solid or mural thrombus. A thickened discolored wall with severe systemic symptoms

may be arrested at the jugular foramen in one direction and at the entrance of the superior petrosal sinus in the other a firm clot with a small central abscess being the result. Such a case as this has been known to undergo spontaneous cure by the discharge of the abscess through the sinus wall and the fistula in the mastoid wall.

Tracing the progress backward, when the clot reaches the horizontal sinus there is nothing to prevent its extending to the torcular venophili or small fragments being carried by the backwash into the torcular venophili and once there, the progress of the infection to the other great sinuses is easy. This question of extension to the opposite sinuses has not received the attention it deserves in literature. I reported a case of infection of the opposite lateral sinus as long ago as 1893<sup>1</sup> and at later dates two other cases one of which had a large abscess in the occipital and temporosphenoidal lobes of the opposite side. My first two cases died the third, in which the local signs were limited to extreme tenderness along the course of the internal jugular vein recovered after a long illness, without operation on the opposite sinus or vein. Mr A. L. Whitehead<sup>2</sup> recorded a case in 1907 which recovered, and Mr C. E. West in discussing the case referred to one in which he tied both internal jugular veins, the patient dying from purulent meningitis. Mr S. Lodge<sup>3</sup> in 1900 published an obscure case which was shown at post mortem to have thrombosis of both lateral sinuses. Voss<sup>4</sup> in a recent paper lays particular stress on backward extension and the means of preventing it. I think this extension is a possibility which is occasionally overlooked, and it is not unlikely that operations in the wrong direction are sometimes performed with the object of arresting systemic infection. When the sigmoid sinus is firmly clotted extension downward appears to me less likely to happen than in a backward direction at one end there is the narrow jugular foramen occasionally crossed by

fibrous septa with the curved recess beyond it into which the end of the clot would first be carried at the other end a wide unobstructed sinus. I conclude, therefore that extension downward, if it takes place at all does so before the sigmoid clot is fully formed or after disintegration has set in or when a half formed or breaking-up clot is disturbed by operation or sudden movements of the head and neck. Such conditions, i. e. the presence in the sinus or vein of septic fluid or semi fluid contents urgently demand immediate ligation and excision or free opening of the vein. When either primarily or secondarily a firm clot has formed in the bulb or in any part of the vein above the common facial, a temporary arrest of its progress may occur either at the exit from the bulb with complete collapse of the walls of the upper segment of the vein, or just above the level of the common facial vein but once it has come under the influence of the facial vein its extension or propulsion downward can only be arrested by a ligature or absolute rest in the dorsal position.

There are thus five stations at which the natural progress of infection may be arrested temporarily—1. at the sinus wall, at the superior petrosal sinus at the entrance into the bulb at the exit from the bulb and finally at the junction of the facial vein. It is for the surgeon to determine what stage has been reached at the time of operation. Whether it is possible to limit the extent of the operation accordingly will depend on the virulence of the process and the clot forming and germ resisting power of the individual's blood.

There is one direction of extension which we have not yet considered viz. along the petrosal sinuses to the cavernous sinus. This is, in my opinion, a comparatively rare occurrence. I have not seen it in the course of a case which began as lateral sinus thrombosis. It has to be considered in relation to ligation of an internal jugular vein which contains a mural or a disintegrating thrombus, in relation to the question of irrigation of the vein or sinus, and in relation to the question of the necessity for the complete exposure of the jugular bulb. Two of my correspond-

<sup>1</sup>Brit. Med. J., March 14, 1893.  
<sup>2</sup>Proc. Roy. Soc. Med., 2, Otol. Sec.,  
J. Laryngol., Rhinol. & Otol., 1900.  
<sup>3</sup>Deutsche Zeitsch. f. Chir. 1903, p. 27.

<sup>4</sup>Ann. Surg., Dec. 16, 1904, p. 2.

necessary operation of exposing the bulb. Having laid bare the internal jugular vein at the entry of the common facial vein we have several courses to consider. If the vein is of normal size and looks healthy and if blood is flowing freely through it compress temporarily and remove the clot from the sinus down to the jugular foramen. If there is a free flow of blood into the sinus plug the sinus after draining and either close the neck wound or put in Voss's provisional ligatures according to the severity and duration of the systemic symptoms. If the vein is collapsed above the facial, but healthy and full of fluid blood below tie in two places and divide above the facial bring the upper end into the wound and endeavor to clear out the clot from the bulb by gentle irrigation. The same procedure can be adopted if the upper vein is clotted, but the clot does not reach to the facial vein and the lower vein is healthy. It is easier to clear the bulb under these circumstances than to do so when the vein is collapsed.

When the clot extends beyond the facial junction it is better in my opinion to tie and divide the internal jugular as low down as possible in the neck. In one case where I had tied the vein below but near the facial everything was going on well when, two or three days after the patient got out of bed in the temporary absence of the nurse with a rapidly fatal result. The presumption is that a healthy clot from the lower vein was dislodged and was carried into the heart.

Having dissected up the vein and tied off the tributaries, including the facial I excise the greater part and bring the upper end into the wound. There is always a temptation to leave the vein unopened the first day for fear of severe hemorrhage but the risk of extension of sepsis from the upper vein is too great, and drainage from sinus to vein should be established at once. As I have already pointed out the danger of irrigation downward is slight, owing to the valvular opening of the inferior petrosal sinus. The wound in the neck may be closed except the upper inch, without packing unless the walls of the vein are diseased though the danger of suppuration along the trachea is a real one. In one

case upon which I operated, but in which the after treatment was not in my own hands suppuration took place with perforation of the trachea and a fatal issue. I have no experience in resection of the clavicle or of any attempt to deal with the subclavian or innominate veins. I have never tied both internal jugulars, nor have I explored both lateral sinuses in the same case. Both of these operations however appear to be within the bounds of practical surgery. Associated cerebral and cerebellar abscess, meningitis, and metastatic abscesses must, of course, be dealt with as occasion demands.

#### ALYCE WALKER FROM TWENTY FIVE OTOLOGISTS AND GENERAL SURGEONS

The following questions were sent to British surgeons, and an analysis of the answers from twenty five otologists and general surgeons is given below.

#### OTITIC SEPTIC SINUS THROMBOSIS

As the result of your own personal experience—

1. Which would you do first—tie the internal jugular vein or expose the sigmoid sinus?

When one rigor has occurred and there is some pain and stiffness of the neck without other signs of vein involvement.

2. When rigors have been repeated and other classical symptoms have been present for several days, but there are still no local signs of the jugular vein being affected.

Where there are local signs of a thrombosis.

3. Suppose the sinus to have been exposed in condition 1. pusulous abscess found, and the sinus wall thickened and covered with granulations—could you explore the sinus at the same operation, and if so, how? Would you tie the vein before exploring the sinus?

4. Do you think it is ever advisable or justifiable not to tie or expose the vein in conditions 1 & 2? Have you any strong views based on actual experience for or against tying the vein at all in any of the above conditions?

5. What do you consider to be the best indications before opening the sinuses?

Of absence of clot.

6. Absence of endocarditis.

7. Viral septic clot with penicillin signs.

8. Primary clotting in the bulb of the jugular vein.

9. Do you employ any special method to determine the extent of clotting? palpation, fluctuation from vein to sinus, or using fork, cannulation, and with what result?

10. Technique of operation.

How do you deal with the torcular end of the sinus?

How do you deal with the distal end when the sinus has not been tied?

11. Where do you tie the internal jugular vein?

12. Do you excise a portion or the whole of the vein?

13. If you do not excise, how do you treat the divided vein?

14. Do you irrigate sinus and vein?

15. If vein is curved, what drainage do you employ?

16. What is your experience of suppuration along the great vessels?

17. Do you consider that it is necessary under any circumstances to expose the bulb?

at an early stage means mural clot at a late stage after a comparatively quiescent period disintegrating clot mild systemic symptoms with partial collapse and a spongy wall at one point, the localized breaking down of a solid thrombus. If the focus of disease is in the tympanum or anterior part of the antrum, with normal appearance and pulsation but increased distention of the sigmoid sinus and if there is pain, tenderness, and stiffness of the neck and presence of systemic symptoms, the diagnosis is primary clotting of the bulb. These and other indications given by some of my correspondents, seem to obviate in the great majority of cases the necessity for palpation or exploratory aspiration of the sinus. Incision should, in my opinion be made not so much as an exploratory procedure but as a continuation of the operation and with the necessity for obliteration of the sinus in one's mind. This being so I expose the sinus until nearly an inch of healthy wall is uncovered on the torcular side and compress it there with a plug of gauze between dura and bone. If after following the sinus down toward the jugular foramen, no healthy wall is reached or if there is any doubt about the condition of the bulb and vein and the systemic symptoms have been severe I expose the internal jugular vein at the junction with the common facial. Hitherto having exposed the vein I have invariably dealt finally with it.

In the future I shall expose the vein as one exposes the sinus—for inspection and not necessarily for obliteration. This was suggested to me by Voss's paper and by my correspondent, Mr. George Wilkinson of Sheffield, who lays great stress on the valuable information as to the condition of the bulb and sinus obtained by exposing the vein. When he does not find it necessary to tie the vein at once, Voss introduces two provisional ligatures formed of strips of gauze around the vein, leaving the wound open so that the ligatures may at any time be tied, without an anesthetic and in the course of an ordinary dressing. This provisional ligature does not seem to me very important, but the principle of exposing the vein for inspection and the

information which may be got thereby appears to be a distinct advance.

Having made the diagnosis as complete as possible by consideration of systemic symptoms, the probable source of infection, inspection of the sinus, and if necessary of the internal jugular vein, we are in position to decide on the extent of operation required and to complete it at once. (I have said nothing about blood counts, lumbar puncture and bacteriological investigations because they do not seem to have any important influence on the extent of the operation—at any rate, of the first operation after this, they may afford valuable information leading to further operation or to the employment of suitable vaccines.)

#### CONCLUSION

In every case of temporal bone disease with symptoms suggesting the presence of a petrous abscess or the onset of pyæmia, expose the sigmoid sinus with the least possible disturbance to its walls until healthy wall is seen and the blood in the part is judged to be fluid and the haemorrhage controllable. This may involve removing bone up to or even including the covering of the torcular herophili, and down to within reach of the jugular foramen. If no disease is apparent except the extradural abscess and the so-called healthy granulations springing from the sinus wall, and if only one rigor has been observed—wait. If the pyæmia is established but not severe and there is a limited occluding clot in the sigmoid, compress above and below clot, remove clot, excise outer wall between the compresses, and pack with gauze. If the sinus is obviously diseased but contents are partly fluid and systemic symptoms marked, expose internal jugular vein in neck. Even if sinus is not obviously diseased, and the blood is fluid and there is severe pyæmia or symptoms of bulb thrombosis, expose internal jugular vein, occlude both sinus and vein, drain, and plug the intervening part. If the sinus is clotted and the lower limit of diseased wall or clot cannot be reached, expose the vein in the neck—this is merely applying the principle of exposing healthy wall beyond each end of the clot, without undertaking the much longer and generally un-

necessary operation of exposing the bulb. Having laid bare the internal jugular vein at the entry of the common facial vein we have several courses to consider. If the vein is of normal size and looks healthy and if blood is flowing freely through it compress temporarily and remove the clot from the sinus down to the jugular foramen if there is a free flow of blood into the sinus plug the sinus after draining and either close the neck wound or put in a loose provisional ligature according to the severity and duration of the systemic symptoms. If the vein is dilated above the facial but healthy and full of fluid blood below tie in two places and divide above the facial bring the upper end out the wound, and endeavor to clear out the clot from the bulb by gentle irrigation. The same procedure can be adopted if the upper vein is clotted but the clot does not reach the facial vein and the lower vein is healthy. It is easier to clear the bulb under these circumstances than to do so when the vein is of lapid.

When the clot extends beyond the facial junction it is better in my opinion to tie and divide the internal jugular a few inches as possible in the neck. In one case where I had tied the vein below but near the facial everything was going on well when two or three days after the patient got out of bed in the temporary absence of the nurse with a rapidly fatal result. The presumption is that a healthy clot from the lower vein was dislodged and was carried into the heart.

Having dissected up the vein and tied off the tributaries including the facial I use the greater part and bring the upper end into the wound. There is always temptation to leave the vein unopened the first day after severe hemorrhage but the risk of extension of sepsis from the upper sinus is too great and drainage from sinus to vein should be established at once. A thick alveolar joint is laid out the distance of irrigation downward. Light owing to the alveolar opening of the inferior petrosal sinus. The wound in the neck may be closed except the upper inch without packing unless the wall of the vein are dissected though the danger of suppuration along the trachea is a real one. In one

case upon which I operated but in which the after treatment was not in my own hands, suppuration took place with perforation of the trachea and a fatal issue. I have no experience in resection of the clavicle or of any attempt to deal with the subclavian or innominate veins. I have never tied both internal jugulars nor have I explored both lateral sinuses in the same case. Both of these operations however appear to be within the bound of practical surgery. Associated cerebral and cerebellar abscess, meningitis and metastatic abscesses must of course be dealt with as occasion demands.

#### QUESTIONS BY FROM TRINITY COLLEGE, ILL. CHICAGO

The following questions are sent to British surgeons and all types of the answers from only a otolaryngologist and general surgeon is given below.

#### OTTIC SEPTIC SINUS THROMBOSIS

As the result of your own personal experience—

1. Which would you do first—tie the internal jugular or expose the sigmoid sinus?

When one rigor has occurred and there is some pain and stiffness of the neck without other signs of sepsis.

2. When rigors have been repeated and other classic symptoms have been present for several days but there is still only a slight enlargement of the jugular vein being affected.

Where there are local signs of thrombosis.

3. Supposing the sinus has been exposed in continuity peritonitis has been found and the sinuses all thickened and covered in granulations—could you explore the sinus at the same operation, and if so how? Would you tie the vein before exploring the sinus?

4. If you think it ever advisable or justifiable not to tie or expose the vein on nodules 1, 2, 3? If yes you are strong views based on actual experience for or against tying the vein in any of the above conditions.

5. What do you consider to be the best indicator for before opening the sinuses?

(1) Absence of clot.

2. Absence of embolism.

3. Mural septic clot, thin permeable sinus.

4. Primary infection in the bulb of the jugular vein.

5. If you employ a special method to determine the extent of intraluminal sepsis, palpation, fluctuation from the external jugular fork, usually 1 cm and 1/2 inch but result.

6. Technique of operation.

How do you deal with the irregular end of the sinus? How do you deal with the distal end when the vein has not been tied?

7. Where do you tie the internal jugular vein?

8. Do you excise a portion or the whole of the vein?

If you do not excise how do you treat the distal end?

9. Do you remove sinus and vein?

10. If you are cured, but drainage do you employ? What is your experience of suppuration along the neck?

11. Do you consider that it is necessary under any circumstances to expose the bulb?

to Have you ever ligated both internal jugular veins or explored and obliterated both internal carotids? If so, how was the result?

Have you ever found it necessary to resect the clavicle or the vertebral vein?

Answers: The above questions were received from the following oncologists and general surgeons:

Logan Turner, Edinburgh, W. S. Kerr, Sheffield, D. R. Paterson, Cardiff, Wilfred Cligg, Birmingham, Adam Dighton, Liverpool, J. B. Fraser, Edinburgh, J. A. L. Kenshaw, Manchester, Harold Mole, Bristol, A. L. Whithead, Leeds, Sir Robert Woods, Dublin, Albert Gra. Glasgow, George Wilkinson, Sheffield, T. O. Graham, Dublin, McKenna Booth, Aberdeen, W. Ross, Glasgow, Bristol, E. M. Stockdale, Liverpool, Constable Hayes, Leeds, W. Pennington, Liverpool, W. T. Cligg, Liverpool, H. A. Ballance, Norwich, W. S. Syne, Glasgow, A. D. Ewart, Leeds, K. W. Mossman, Liverpool, Sumner Lodge, Bradford.

I. T. Only two expose veins only without exploring it. Two explore veins, then tie the vein. One ties the vein, then explores veins.

b. T. Always explore and slit up veins only. Four expose veins, then tie vein. Thirteen explore the veins and then tie vein if necessary. One exposes the vein for palpation. Five tie the vein first, then explore the veins.

c. One explores veins alone. One explores veins, then opens the vein, if clotted, without ligating it. Eight explore veins first, three of these tie vein occasionally in the vein always. Fourteen tie vein first.

II. Two never explore veins at first operation. Eight use expose veins, and wait or act according to findings. Five if intending to explore veins, tie vein first. Six do not tie vein first, and four are doubtful.

III. Is. Nineteen consider it justifiable and tie. One thinks it is never justifiable not to tie the vein.

I. b. Seven think it sometimes justifiable not to tie vein. Five never justifiable. Two never tie the vein.

I. Twelve think it never justifiable not to tie vein. Two never tie the vein.

IV. a, b and. Eleven give no answer or say there are no trustworthy signs. Nine employ palpation of the veins with or without fluctuation from vein to veins. Most rely on color, distention, pulsation, density of contour of all, and presence or absence of systemic symptoms.

d. Answers too varied to classify. W. S. Kerr. Do ligate veins with septic temperature chart, labyrinthine symptoms, tenderness between the vein and mastoid.

J. S. Fraser. Great bleeding during mastoid operation from bone and emissary veins. Kenneth Kenshaw. Healthy veins, fluctuation in veins when pressure applied along vein. Hamilton A. Ballance. Pyrexia with absence of change about the veins. W. S. Syne. Temperature chart, rigors, absence of upward flow into veins. O. Wilkinson. Lactations got from exposure of vein in the neck. E. M. Stockdale. Thrombosed veins with healthy mastoid. Constable Hayes. Pain on swallowing referred to tonsillar area, associated with mastoid symptoms. T. O. Graham. Early stiffness of neck and no marked local signs around mastoid at operation.

V. No mention is made of using fork. fluctuation seen of absence of bruit or double.

VI. Six discuss then plug the foramen of bleeding. Two remove, fold a silk in, and pack. Eight use gauze pressure pads, and one uses rubber sponge. Twelve remove clot until blood comes. One leaves it alone.

Eight plug the foramen. One folds in silk and packs. Four use gauze pressure pads. Five remove clot until blood comes. Four leave alone.

3. Nine above the facial vein if there is no clot below. Eight below the clot. Six always below the facial vein. Two at "root of neck." T. Opposite thyroid. Two opposite thyroid.

4. Thirteen cross veins. Two, all. Two, as much as possible, less clot present. Five, damaged part. One, remainder after stitching upper end in the wound.

5. Four double ligatures, divide vein, and tie in wound. Sixteen double ligatures, divide, and fasten upper end in wound. One inserts tube and gauze in vein (upper end). One uses Ballenger's sub-oculic method. One picks it. Three open vein freely in air.

6. One vein only. One vein tied and cut separately. Nine through from sternum to vein. Ten do not irrigate. Four sometimes irrigate.

7. Three, gauze. One split rubber tube. Three, gauze within rubber tube. One, iodine-former soaked. Several did not reply.

8. Ten had never seen it. Four considered it dangerous. One thought it rare, if seen brought out of wound. One had only a small localized abscess. Three said it was easily cured by drainage.

9. Seven. No. Two, if fully thrombosed. One thought it might occasionally be necessary but had not done the operation. Five, when symptoms continue after complete treatment of vein and focus. Two when ligature on fails. Four when extracranial, because invades jugular veins.

10. One (only) patient recovered (Whitehead, Proc. Roy. Soc. Med. Otol. Sect.).

NIL

POLYCYSTIC KIDNEY<sup>1</sup>

B. CHARLES E. BARNETT, M. D., F. A. C. S., FORT WAYNE, INDIANA

**I**N a former paper upon this subject before this association the writer endeavored to show that our statistics were insufficient to cover the subject of unilateral polycystic kidney. A number of opinions were given to show the divergent views entertained regarding the etiology and pathology of the disease. An operative case was reported thus showing the logic in operative procedure rather than non-operative as recommended by most authorities.

This paper endeavors to cover thoroughly the numerical, diagnostic, and prognostic statistics of the subject in the United States. The writer knows that there are some omissions but thinks that the commission where the number of cases are overstated by pretenders will equalize the omissions. Quite a number of cases were rejected on account of their unreliability.

One of the factors that add to the difficulties of a differential diagnosis between unilateral and bilateral disease is the astonishingly small amount of true kidney substance that is required to sustain life.

The fact that the remaining kidney cannot be cut into during the operation in order to prove it to be non-pathologic at that time and considering the maze of mystery and doubtfulness concerning the etiology of the disease makes an absolute diagnosis impossible for should we consider the cause (outside of foetal tubular misalignment) a block of the uriniferous tubules or chemical changes such as arsenic or aniline dye poisoning brings about or the involvement of the renal lymphatics, these changes could readily occur following the nephrectomy when one considers that a double load is placed upon the remaining kidney with the same economy working that had produced polycystic changes in the other kidney.

It was naturally quite impossible to get detailed histories from any great number of

cases, because of the number of years covered by the operators and the inaccessibility of case records even when case reports had been kept. The interest that the majority of the ablest men working in that line of surgery manifested by their letters explaining certain phases of their case reports, indicated to the writer's mind two facts. First, that the subject needs more investigation second that the conscientious worker no matter how busy is ready and anxious to give his assistance in such an investigation.

The whole number of polycystic kidney cases reported and considered authentic was 251 bilateral 150 unilateral, 101<sup>4</sup> of this number 9 unilateral cases were still living 104 had operative recoveries and 58 died.

The first choice in nomenclature was polycystic kidney second choice "congenital cystic kidney."

Congenital defects, associated with cysts of the liver etc. were reported as follows: One cystic goiter two cysts in breast one liver was nodular one case was associated with cysts of liver and spleen. Heredity was a factor in four cases infection was present in thirty-one mixed infection in eighteen colon bacilli in seven tuberculosis in five pneumococci in one.

Visceral ptosis was present in eight arteriosclerosis in eight uræmia in seventeen dysuria in eighteen hæmaturia in twenty-two polyuria in twenty-five.

In the urinalysis the specific gravity was low in 15 cases, high in 10 the lowest specific gravity was 1002 highest, 1030. Albumin was found in 24 casts in 12. Four were normal.

The most frequent predominant symptom was tumor in 23 cases. Other symptoms suggested were Pain, 20 polyuria, 6 uræmic coma, 5 hæmaturia, 6 anuria, 4 backache 3 general malaise 2 ptosis, 2 toxæmia 6.

These hundred and forty-nine cases were reported on first card by 81 different men, 46 unilateral 23 cases (31 bilateral, 15 unilateral) were included on account of not responding to second card proved, 23 cases (3 bilateral and 20 unilateral) were literary not as coming from personal history, 12 cases (10 bilateral and 2 unilateral) proved by second card systems for more details, were the ones considered as not listed.

Read before the American Urological Association, Philadelphia, June 29, 1924.

<sup>1</sup>Unilateral polycystic kidney designated when the surgeon has, by palpation, been certain that, etc. proved according to his best judgment that the other kidney is free from cysts.

Have you ever ligated both internal jugular veins or explored and obliterated both lateral axillae? If so, what was the result?

Have you ever found it necessary to resect the clavicle or the vertebral vein?

Answers to the above questions were received from the following otologists and general surgeons:

Lagan Turner, Edinburgh, W S Kerr, Sheffield, D R Paterson, Cardiff, Wilfred Clegg, Birmingham, Arthur Dighton, Liverpool, J S Fraser, Edinburgh, J A K Renshaw, Manchester, Harold Mole Bristol, A L Whitehead, Leeds, Sir Robert Woods, Dublin, Albert Gray Glasgow, George Wilkinson, Sheffield, T O Graham, Dublin, McKenna Booth, Aberdeen, Watson Williams Bristol, E M Stockdale, Liverpool, Constable Hayes, Leeds, W Pennington, Liverpool, R T Clegg, Liverpool, H A Ballance, Norwich, W S Sykes, Glasgow, A D Sharp, Leeds, K W Moosarrat, Liverpool, Samuel Lodge Bradford.

I Twenty-two expose veins only without exploring it. Two explore axillae, then tie the vein. One ties the vein, then explores axillae.

2 Two always explore and shut up veins only. Four expose axillae, then tie the vein. Thirteen explore the axillae and then tie vein if necessary. One exposes the vein for information. Five tie the vein first, then explore the axillae.

3 One explores axillae alone. One explores axillae, then expose the vein, if clotted, without ligating it. Eight explore axillae first, three of these tie vein occasionally. Five tie vein always. Fourteen tie vein first.

II. Two never explore axillae at first operation. Eight expose axillae, and wait or act according to findings. Five, if intending to explore axillae, tie vein first. Six do not tie vein first, and four are doubtful.

III. 15. Nineteen consider it justifiable not to tie. One thinks it is never justifiable not to tie the vein.

I 6. Seven think it sometimes justifiable not to tie vein. Five never justifiable. Two never tie the vein.

I 7. Twelve think it never justifiable not to tie vein. Two never tie the vein.

IV. 6 and 11. Eleven give no answer or say there are no trustworthy signs. Nine employ palpation of the axillae with or without fluctuation from vein to axillae. Most rely on color, distention, pulsation, density of contour of wall, and presence or absence of systemic symptoms.

4. Answers too varied to classify. W S Kerr Delayed rigors with septic temperature chart, labyrinthine symptoms tenderness between the jaw and mastoid

J S Fraser Great bleeding during mastoid operation from bone and emissary veins. Knowles Renshaw healthy axillae, no fluctuation in veins. Gas pressure applied along vein. Hamilton A Ballance Pyrexia with absence of disease about the axillae. W S Sykes Temperature chart, rigors, absence of upward flow into axillae. G Wilkinson. Indications not from exposure of vein in the neck. E M Stockdale Thrombosed axillae with healthy mastoid. Constable Hayes Pus on exposure referred to tonsillar area, associated with mastoid symptoms. T O Graham Early stiffness of neck and no marked local signs around axillae at operation.

1. No mention of trade of turning fork. indication not of absence of breast de table.

VI. Six drain, then plug the humeri if bleeding. Tissue, fold walls in, and pack. Eight use gauze pressure pads, and one uses rubber sponge. T also remove clot until blood comes. One leaves it alone.

Eight plug the humeri. One folds in walls and packs. Four use gauze pressure pads. Five remove clot until blood comes. Four leave alone.

3. Nine above the facial vein if there is no clot below. Eight below the clot. Six always below the facial vein. Two at root of neck. T opposite thyroid. Two opposite cricoid.

4. Thirteen expose nodes. Two all. Two as much as possible, then clot present. Five, dissected part. One, remainder after stitching upper and to the cord.

5. Four double ligature, divide vein, and leave in wound. Seven double ligature, divide, and leave open and in wound. One inserts tube and gases in vein (upper end). One uses Ballenger's stab-wound method. One packs it. Three open vein freely as rule.

6. One axillae only. One axillae and ax separately. Nine through three axillae to vein. Ten do not ligate. Four sometimes ligate.

7. Three, gauze. One, split rubber tube. Three, gloves within rubber tube. One, kodak film coated. Several did not try.

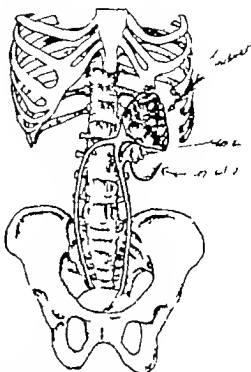
8. Ten had never seen it. Four considered it dangerous. One thought it rare if vein brought out of axillae. One had only small hard abscess. Three said it was easily cured by drainage.

9. Seven. No. Two, if both thrombosed. One thought it might occasionally be necessary but had not done the operation. Five, when symptoms continue after complete treatment of vein and axillae. Two, less signs, too faint. Four when extraxillary abscess precedes jugular signs.

One (only) patient recovered (Whitehead, Proc Roy Soc Med. Otol Sect.)

1. No

Nicholson, C M	3	3
O Crowley, C R		
Ochsner, A J	4	4
Peck, Charles		
Perry, J F		
Palcher, P M		
Polak, John O	4	4
Porter, Miles F		
Rader, Francis		
Robson, C R		
Schupen, S Wilham		
Schwyer, Arnold		
Senn, Wilham N	3	3
Smith, A Laphorn		
Smith, E E		
Smith, G G		
Spatzer, W		
Stone, I S	3	
Tamm, Frederick Joseph		
Taylor, H C		
Tenney, Benjamin		
Torrance, Gaston		
Townsend, Wilham W	3	
Tuerck, Raymond C		
Vander Veer, Drs		8
Winkfield, F B		
Warren, J N		
Ward, G G		
Wick, Ferdinand	6	5
Wells, Brooks H	3	
Willard, W P	4	3
Wilson, Nelson W		
Wright, A L	3	3



In the cases traced the following lengths of time had elapsed following the post-operative recovery with the patient either still living or dead

UNILATERAL		BILATERAL	
No. of cases	Age	No. of Cases	Age
	5 years		6 years
	8		5
	0		4
	8		3 1/2
	6	yes	3 months
3	5		5 months
	1		
4	1 1/2		
	8 months		

Fig. An anomalous left kidney (no kidney found on the right side) with the right ureter coming from the upper half of the pelvis, the upper pelvis communicating with the lower pelvis and left ureter, stone present in the pelvis with the upper two-thirds of the kidney polycystic and the lower third normal kidney tissue

Torrance, Gaston, 1 case alive after 2 years 6 months

Smith, E E case alive after 18 years

Through the courtesy of Dr J N Vander Veer the writer is privileged to give the following unusually interesting anomalous polycystic kidney case

Mr C B age 45, bookkeeper Pain in left side 6 weeks history Father died from poplexy aged 60 mother during parturition, aged 4 paternal uncle aged 2 died from tuberculosis

History Patient had had scarlet fever during childhood, gastritis at 25, and typhoid at 35 About 14 months ago had stomach trouble with bilious vomiting after which grippe and pleurisy confined him to bed for ten days At present complains of nausea, weakness, bronchitis, poor appetite and rested after sleep 7 weeks ago nose bled for five hours

Physical examination Skin pale red with 3-400000 hae cells, 8500, haemoglobin 100 cent temperature 98° F pulse, 80 stroke 14 pressure 112 diastolic, 60 heart mildly abnormal

The following nine unilateral cases, where nephrectomy was done are reported by the following men as still living

Ruebhoff, Frederick	case alive after	years
Barnett, Charles F	case alive after	years 1 month
Bryan, Robert C	cases one alive after 3 years, and one after 8 months	
Geiger, Jacob	cases one alive after 6 years, and one after 5 years	
Nicholson, C M	case alive after 4 years	

Thirty-seven males and 54 females were reported. The youngest was 5 years the oldest, 76 years. One case was reported as congenital in foetus. The disease occurred most frequently between the ages of 40 and 50 average age about 41½ years.

The following is a list of ages of patients in which polycystic kidney occurred

BILATERAL		UNILATERAL	
No. of Cases	Age Years	No. of Cases	Age Years
	76		75
			65
	60		60
			50
			35
			5
	50	9	50
	40		
			48
			47
			46
			45
	44		44
	42		43
	42		
			4
	40	4	40
	39		
3	33	3	32
	37		
		3	30
4	35	5	35
3	34		
			33
			3
	30		30
	30		30
3	6		9
			5

When unilateral the differential diagnosis was made in—

- Five cases by exploratory incision
- Seven cases by cystoscopy and ureteral catheterization
- with functional kidney tests,
- fourteen cases by the irregular outline of the large kidney
- Six cases by abdominal section
- One case by the X ray
- F cases by autopsy

The men reporting cases are as follows

Name, Ldw T	No. of Cases Reported Unilateral	
	6	5
Anspach, Brooke M		
Valky, Thomas A		
Belch, F G	5	4
Barnett, Charles F		
Beck, L G		
Bettsfield, W T		
Benjamin A L	8	5
Beran, A D	5	4
Bercholt, Frederick		
Boldt, H J	3	3
Bonsfield, C L		
Booney, C W		
Bowte, J Wesley		
Brookman D C		
Brj, A, R C		
Buchanan John J		
Bugbee H G		
Burger A J		
Cahot, Harsh		
Chute, A L		
Cotton, F J		
Cullen T S		
Cushman E W		
Davis, Lincoln		
Deintour H B		
Dickerson, Robert L		
Dickerson, Gordon K		
Fagleson, J B		
Fennell, John G		
Fennell, Joseph Riles		
Edgar James Clifton		
Edwards, E G		
Frederick, D N		
Littner Arthur R		
F y Oliver J		
Felchick, D S		
Fletcher T A		
Finner, Charles H		
Goodley, Hubert		
Frisk, Wm J		
Foller William		
Genger Jacob		
Gerrigity John T		
Gerrigity, J A		
Gordon Seth C		
Griffith J D		
Gre, C H O		
Gutierrez Ramon		
Hansen, W D		
Hall, R B		
Hannum, Carl A		
Hartman C M		
Harris, D L		
Harris P A		
Hill, Howard		
Hoist, B C		
Jepson, W M		
Johnson A M		
Jones, E		
Jopson, John H		
Jordan William M		
Keller John O		
Keyes, Edward L		
King, Alfred		
Kaott, Van Buren		
Krotzmayner Martin		
Law Arthur A		
Lockwood, Charles D		
Lord, J P		
Land, I B		
McKenna, C M		
M Vay, John R		
Mama, Arthur T		
Mason, W P		
Matta W M		
M y Chance		
Merrithew F T		
Montgomery Edward F		
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## PSEUDOMYXOMA OF THE PERITONEUM

BY ELIZABETH G. LEWIS, M. D., SAN FRA. CALIF.

From the Pathological Laboratory of the University of California Hospital

**A**LTHOUGH cystadenomata of the ovary are not malignant in the sense that they metastasize through the lymph and bloodstreams nevertheless they occasionally give rise to secondary growths called implantation metastases. The mode of formation of such metastases is scarcely open to doubt. The cyst ruptures either spontaneously or as the result of manipulation during the operation for its removal a portion of its contents escapes into the abdominal cavity and the movement of the intestines freely disseminates the material. This material contains epithelial elements that may become attached to the peritoneum, undergo proliferation and reproduce the structure of the original cyst. In case of rupture of a pseudomucinous cyst the implantation of the epithelial elements and the subsequent generation of daughter cysts may be confined to a small area or a single organ, as, for example the appendix or on the other hand the affected area may be extensive involving a large part of the peritoneum. In the latter event the resulting condition is designated pseudomyxoma of the peritoneum.

Other names suggested for this disease of the peritoneum have become obsolete since the nature of the lesion has been better understood. Thus the designations pseudomyxomatous degeneration of the peritoneum (Mennig) and chronic myxomatous peritonitis (Virchow) were prompted by the erroneous idea that they were dealing with a primary disease of the peritoneum. That this is not the case was first demonstrated by Werth who clearly established the relationship between myxomatous changes in the peritoneum and pseudomucinous cysts of the ovary. Since the appearance of his monograph in 1884, pseudomyxoma peritonei the name he suggested for the lesion, has been permanently adopted.

Pseudomyxoma of the peritoneum is not a frequent complication of pseudomucinous

cysts. In 1891 Straassmann was able to collect from the literature only thirty-six cases and in 1908 Schumann added twenty others. Wilson has recently reported six cases which came under his personal observation and computed that about 4 per cent of the cases of pseudomucinous cyst are followed by this complication. Not infrequently a long period of time elapses between the removal of the primary tumor and the development of the peritoneal lesion. And perhaps this is the most remarkable clinical feature of the case following for 22 years elapsed between the time when the patient was operated upon for the removal of ovarian cysts and the time when she applied for treatment and was found to be suffering from pseudomyxoma of the peritoneum.

M. D. white widow age 60. Admitted to the University of California Hospital, October 28, 1909. Complaints of swelling of the abdomen with tenderness and pain chronic constipation increased frequency of urination extreme weakness. *Family history* One sister died of cancer of the breast. Husband died of pulmonary tuberculosis 30 years ago. *Past history* Diseases of childhood, including scarlet fever. Menstruation began at 7 and occurred regularly every 8 days. Patient has had one child which died in infancy no miscarriages. When 38 years of age patient was operated upon for an abdominal tumor. Bilateral ovarian cysts were removed which together weighed 9 pounds. After the operation menstruation did not reappear.

*Present illness* began eight months before admission to the hospital, when patient began to suffer from abdominal pain and subsequently she steadily lost in weight. *Physical examination* Patient is markedly emaciated. Heart and lungs negative. Abdomen is very much distended with fluid and large irregular tumor mass is palpable over the whole front of the abdomen. On vaginal examination the mass seems to be connected with the uterus or the structures immediately to the right of it. *Blood exam.* *slim* Red blood corpuscles, 4,600,000. White blood corpuscles, 6,800. Hemoglobin 4 per cent. Urine contains faint trace of albumin but no casts. Specific gravity .008 Wasserman reaction negative. *Exploratory laparotomy* November 9, 1909 by D. W. G. Moore. A large irregular tumor mass fills out the abdomen and is inseparable as it is attached to the right broad ligament. A great number of small cysts are scattered the

the malleoli in some such way that they will hold the astragali in that position. This can sometimes be done by manipulation and a subsequent plaster wathe or cast, but many cases require subcutaneous nailing to hold both sides in position. Where bimalleolar fracture is complicated by rupture of the interosseous ligament and a separation of the lower end of the tibia bone with a possible forcing upward of the astragali between them, nothing short of open operation with the two bones pressed together, the astragali returned to its proper articular position and the two malleoli nailed on and the tibia nailed

three weeks. Then the weight may be gradually applied. If painful this is ample evidence that the callus is not yet matured and a further wait is necessary.

At the inception of weight bearing if the external malleolus has been the greatest sufferer in the fracture the patient should be cautioned to hold the foot straight forward or with toes turned slightly in and the inner side of the heel and sole should be raised slightly. This holds the foot in better weight bearing axis and helps avoid a twisting of the young callus in the fibula and the weakened internal lateral ligament.



Fig. 8 A

Fig. 8 B

Fig. 9 A

Fig. 9 B

Figs. 8 A and 8 B. Fracture just above joint. Not posterior deformity in lateral view of which no hint is given in the front view and case here the mathematical calculation derived from the front view would lead one into serious error. Figs. 9 A and 9 B. Repair by open

tion and insertion of right angled steel plate of fracture shown in Fig. 8. Tibia brought into alignment and not cut out upper and lower fragments into which the right angled plate is inserted and then screws driven in to hold pieces. This makes very firm support in both planes. Claps also

to the fibula, will preserve good function and prevent the wide painful nodule. After such operation or happy mechanical reduction in bimalleolar fracture the foot should not be put up in adduction but should rest at a right angle and be allowed a long immobilization to permit the malleoli to unite firmly with a minimum of callus and the callus to mature also to allow the torn ligaments to reunite a process which takes longer than bony union and to establish a normal circulation of rest in the ankle. When the splint is removed, very light massage and passive motion may be indulged in, but not to point of pain at any time and no weight bearing on the foot should be allowed for two or

Besides the mathematical calculation of position of the astragali, one must take into consideration fracture of the extreme edge or lip of the articular surface of the tibia. By this I mean a splitting off of a wedge like piece usually of the compact bone along the line of fracture starting at the joint and extending upwards along the shaft for a varying distance of one-half to two inches or more. These are much like the sprain fractures at the wrist and are caused by a similar mechanism i.e. wedging force upwards by the astragali which force may be in a direct line upwards or at a varying angle and directed toward the anterior, posterior or outer side of the lower end of the tibia de-

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murmurs lungs left-sided mucous riles and signs of pleuritic adhesions

**Cystoscopy.** Mild cystitis and trigonitis ureteral openings normal catheter up left ureter gives cloudy purulent material stopped at 6 inches catheter up right ureter 19½ inches easily passed clear urine Examination indicates left pyelitis X-ray shows stones in left kidney pelvis with kidney misplaced low down in the pelvis right side negative. (Unfortunately a loaded catheter was not passed for skiagraph)

**Operation.** Kidney delivered found bipolar upper half polycystic in lower half pyelonephritis with stones in pelvis the bifurcated ureter traced from upper half of kidney pelvis leading down and joining bifurcation of the lower left ureter which drained the lower kidney pelvis the upper and lower portions of the pelvis non communicating Incision was enlarged and hand passed to right kidney which was found apparently normal (At autopsy an extra lobe of the liver was found occupying the right kidney fossa.) Left nephrectomy was done Death occurred one week later from uremia Autopsy showed bases of right kidney with the right ureter crossing over and joining with the upper bifurcation of the left ureter to drain the upper pelvis, which controlled the superior and middle poles of the kidney which was polycystic while the lower pelvis drained a shell of normal kidney substance whose destruction had been brought about by itself retained calculus (See Fig.)

The only way in which this unusual anomaly might have been diagnosed would have been for one to pass the loaded catheters as a routine, in order to reveal a condition that might not occur again in many lifetimes of work.

In this case the physical findings were not especially bad. While it is of especial interest from its anomalous standpoint, the writer believes it presents some interesting con-

jectures from a polycystic view. It would seem that the polycystic portion had been acquired rather than congenital for had the cystic change been present at birth, compensatory enlargement would have been present in the lower segment sufficient to sustain the body. The fact that a single kidney was cystic above and non cystic below would add another point in disproving the claim that polycystic disease always occurs bilaterally.

#### CONCLUSIONS

1. The number of bilateral and unilateral polycystic kidneys is overwhelmingly greater than our present textbook statistics would indicate.

2. The question of infection has arisen only in recent years consequently future time is necessary in order to show the part of its importance.

3. The known etiological factors are so few that one must necessarily conclude from the number of hypotheses given, that there are several causes for polycystic kidney disease.

4. Nephrectomy in unilateral cases, where the opposite kidney is proved competent especially when the tumefied kidney has produced a pitted viscera, is undoubtedly indicated.

5. From the years elapsing since nephrectomy was done in a number of cases reported one is led to believe that a unilateral polycystic kidney condition did exist.

NOTE.—Any one reading this article who has had one not reported in these statistics will confer favor if he will mail writer card for blanks to be added on in order to increase the value of these statistics.

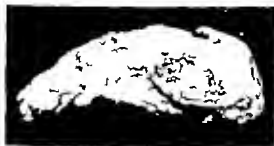


Fig 2 Pseudomyxoma peritonei, spleen

development of pseudomyxoma of the peritoneum occurs in cases when the original tumor has been removed intact and to all appearances completely. Such cases however must be explained by the fact that remnants of the tumor were overlooked and left behind.

The variability of the period elapsing between the removal of pseudomucinous cysts and the development of pseudomyxoma of the peritoneum cannot be satisfactorily explained. Generally an interval of seven or eight years elapses but occasionally the interval has been as short as five months or as long as 14 years (Tannen), 17 years (Ohlhausen) and 22 years (author's case). Such long intervals however are exceptional. Most observers emphasize the rapidity with which the secondary growths develop.

In a measure, variations in the time required for the development of pseudomyxoma of the peritoneum are due to the presence of two opposing pathological processes. Primarily epithelial elements from the ovarian tumor become implanted upon the peritoneum and reproduce the structure of the original cyst. Secondly the peritoneum reacts to the stimulus of the implantations and this reaction constitutes a chronic peritonitis. The proliferation of the peritoneal stroma about the cysts is unfavorable to their growth by interference with this expansion and with the nutrition of the cells which form their lining. Consequently desquamation and degeneration of the epithelium takes place and this process actually tends to limit the disease. It probably explains the very rare cases in which the disease is known to have undergone spontaneous cure.



Fig 3 Pseudomyxoma peritonei liver

More frequently on the other hand it happens that the cysts rupture, their contents are extruded into the peritoneal cavity or into the surrounding tissues, and the implantation cysts are rapidly multiplied. Death is generally due to cachexia which is the result of interference of the normal activity of the stomach and intestines.

Chemical study of the contents of these cysts has attracted a number of investigators, and has led to the identification of a substance which Hammarsten called pseudomucin. This is distinguished from mucin, as Donat first pointed out, by the fact that no precipitate is formed on the addition of acetic acid nor does boiling cause precipitation. Later Hammarsten demonstrated the presence of a reducing substance in pseudomucin and Zangerle devised a method for isolating the reducing substance (glucoseamin). In very few cases, however, has careful examination been recorded. In the case here reported the material for examination was ascitic fluid obtained at operation November 9, 1912 three months before death.

The fluid consisted of about 4,000 ccm of a slightly turbid reddish brown fluid having a specific gravity of 1.021 and a faintly alkaline reaction to litmus. Floating in the fluid were hundreds of amber-colored gelatinous masses having an average diameter of about 5 mm. The microscopic examination showed granular material but no cells. On removing the gelatinous masses the ascitic fluid showed the following characteristics. Upon heating there was formed a thick friable coagulum of albumin. Globulin and albumin

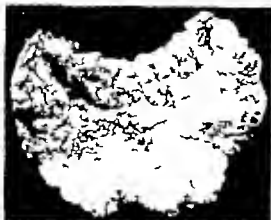


Fig. Pseudomyxoma peritonei, omentum (posterior view)

parietal peritoneum especially over the ventral portion. About 4 liters of sacric fluid were withdrawn from the abdominal cavity. In this there were myriads of small free cysts some clear and others opaque. A number of the cysts measured from one to two cm in diameter.

Post operative convalescence was at times and the abdominal incision healed promptly but the patient progressively lost in weight and strength. February 3, 1913 she died of cachexia. Autopsy eight hours after death by Dr. J. V. Cooke.

**Anatomical diagnosis:** Pseudomyxoma of the peritoneum and omentum with complete encapsulation of the spleen, liver and uterus by the tumor. Chronic adhesive pleuritis. Parenchymatous degeneration of heart, liver and kidneys.

The following is a brief abstract of the pathological findings. The body is that of an emaciated white woman 60 cm in length. There is discharge of foul smelling gastric content from the mouth. The abdomen is considerably distended and there is an old surgical incision above the umbilicus in the median line. Upon opening the peritoneum there escapes a considerable amount, probably about 1500 cc. of grayish fluid in which there are grayish flecks and small jelly like masses. The anterior abdominal wall is adherent to the underlying structures and on freeing it the omentum is found much enlarged and thickened, though its normal shape is preserved (Fig. 1). It measures from 3 to 5 cm in thickness and is composed of a grayish tissue thickly studded with nodules 1 to 15 mm in diameter composed of jelly like substance. In the splenic region there is a tumor mass shaped like a moderately enlarged spleen and measuring 14 x 8 x 6 cm. On section there is no covered on the much of the mass small, dark red, rather friable spleen measuring 6 x 5 x 4 cm (Fig. 2). In some places the jelly like tumor nodules

directly continuous with the main encapsulating mass, are seen invading the splenic tissue but no metastatic growths are seen in the substance of the organ. A portion of the tail of the pancreas is buried in the perisplenic growth.

Also covering the entire surface of the liver is found a thick tumor capsule varying from one to four cm in thickness, but no metastases are found in the hepatic tissue (Fig. 3).

The pelvic peritoneum and viscera show an irregular nodular coating in some places 4 to 5 cm in thickness. The uterus is small and encapsulated by the tumor. The fallopian tubes and ovaries are not found.

Many tumor foci are found over the surface of the stomach and intestines. Some of these are 5 cm in diameter and others are smaller matting together the coils of gut. No lesions are found in the mucosa of the alimentary canal. The kidneys and adrenals show no unusual features. The thoracic viscera present nothing abnormal except some old fibrous pleural adhesions. Brain and cord were not examined.

**Microscopic examination:** Portions of the tumor growth taken from various places show the same microscopic picture. The tumor consists merely of a mass of cysts held together by a fibrous stroma. The cysts vary considerably in size from one to fifteen millimeters, and as a rule are circular or oval, although occasionally irregular shapes are seen suggesting pocket like outgrowths. In places the cyst cavities are lined by a single layer of cylindrical epithelium but there is a remarkable tendency to desquamation and many of the cysts show no lining epithelium when found it is usually limited to a small portion of the cyst. The epithelial cells are usually cylindrical and of the goblet-cell type but even in the same cyst may be also cuboidal or flattened. The cyst cavities contain homogeneous material which takes the hematoxylin stain. The fibrous stroma, upon which the epithelium lies, varies in amount in different cysts and is rather poor in cells.

Sections of the viscera show nothing worthy of note except a parenchymatous degeneration of the heart, liver and kidneys.

Bilateral pseudomucinous cysts, such as were removed in this case when the patient was 38 years old, are somewhat more likely to be followed by a recurrence of the growth than unilateral cysts. Pfannenstiel states that extirpation affords complete and permanent relief in 98 per cent of the cases of unilateral cysts but in only 85 per cent of bilateral cysts. If the cyst should rupture at the time of operation recurrence is feared but by no means does it occur invariably. On the other hand, local recurrence or the

## ENCHONDROMATA WITH SPECIAL REFERENCE TO THE SCAPULA

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CARTILAGINOUS tumors in various parts of the body occur with relative frequency and have attracted considerable interest and study. More than one hundred and fifty articles referring to tumors of this type were readily found, most of them being simple case reports. Others, however, dealt with their etiology and pathology and with the technique of their removal.

In a classification of chondromata, based upon their origin and development, two types are distinguished. The first (the homoplastic group or enchondroma) represents a pathological overgrowth of preexisting normal cartilage; the second (the heteroplastic group or chondrosarcoma) those which develop where no cartilage is normally found or as expressed by Miller, where there is nothing.

In general, chondromata reproduce the histology of the various types of normal cartilage. Those of the hyaline type are the most common, other forms being seldom found. In these cases the various types of cartilage may occur in different portions of the same tumor, a combination of the fibrous and the hyaline being found most frequently. The histological structure of the superficial portions of these tumors approaches the picture of the normal cartilage most closely, while the variations from the normal arrangement, size and shape of the cells become more pronounced the deeper the tissue in the tumor (16). The number of cells in contrast to the ground substance is usually increased. Enchondromata may occur also in combination with sarcomatous or cancerous cells.

Chondromata not only reproduce the histology of normal cartilage, but also the general structure with the complete absence of blood vessels and nerve fibers in the cartilaginous or lobules. Hence all chondromata tend to undergo degeneration if they grow much beyond the size of the normal cartilaginous structure. This degeneration

may be (1) mucous, (2) calcareous, or (3) fatty (fat globules in the cells). Chondromata that contain large stellate (5) cells are usually subject to the greatest mucous degeneration. This degeneration may be so extensive as to cause fluctuation in the tumor. The fluid is of the consistency of the white of an egg and is opalescent, with loose masses of softened tumor floating free in it. However, some enchondromata tend to develop lobules more or less sharply held apart by fibrous tissue and these do not undergo degeneration so readily. (6) When degeneration does occur, it is due to the compression of the blood vessels by the gradually enlarging lobules. Under such circumstances degeneration is likely to be of the calcareous type. This was markedly true in the case reported at the end of this paper. The fatty degeneration is confined to the cells and is never extensive.

Most chondromata contain chondrin. However, this is not necessarily true. Virchow reports a malignant case in which the tumor yielded no chondrin, although histologically it was composed of typical hyaline cartilage.

Cartilaginous tumors are usually benign and cause no trouble except by their size and position and come to the surgeon only after they have been in existence a long time. While they are usually tumors of slow growth, a cessation of growth or a retrograde change is rare. (6) That they may develop in dangerous localities and cause serious disturbances, however, is shown by a case reported by Clark and Atwood (1) of a typical multiple enchondromata ranging in size from a pea to a small orange. This case occurred in a seventeen-year-old boy. The patient and his relatives believed that these swellings came and then disappeared spontaneously, undergoing retrograde changes after they had reached a certain size. One swelling finally developed in the scapula, turcica and caused eye symptoms, paroxysmal headache and a progressive spastic quadriplegia. However, the eye symptoms improved somewhat, which

were salted out by half saturation and saturation respectively with ammonium sulphate heated washed dried and weighed total nitrogen and uncoagulable nitrogen were determined by the Kjeldahl method. The following results were obtained:

Cost per one can
2 45¢
3 35¢
55
45

Serum globulin  
 Serum albumin  
 Total nitrogen  
 Unmeasurable nitrogen

A positive test for pseudomucin was obtained by Hammersten's method as follows. Fifty ccm. of the fluid was diluted with an equal volume of di-distilled water faintly acidified with acetic acid, boiled, and filtered. This clear filtrate free from coagulable protein or any mucin that may have been present was evaporated to small volume cooled and five times its volume of absolute alcohol added. The resulting heavy white precipitate was filtered off washed with absolute alcohol and redissolved in distilled water there being formed a faintly opalescent fluid. This was tested for pseudomucin by hydrolyzing with an equal volume of 10 per cent HCl on a water bath for two hours until the fluid became a clear brown color. It was then filtered and upon neutralization with 40 per cent NaOH gave a well marked reduction of Fehling's solution.

Mucin could not be demonstrated in the fluid. The addition of acetic acid gave a marked cloudiness which could not be filtered off. The precipitate formed on heating with acetic acid showed no reducing substance after hydrolysis with HCl.

The gelatinous masses in the original fluid when heated became thick, opaque white and friable. In normal salt solution they swelled, became clear and transparent and did not dissolve in 48 hours. In  $\frac{N}{10}$  NaOH they swelled and after several hours dissolved.

leaving a fibrous material, possibly the cyst capsule. Ten per cent acetic acid caused the masses to shrink and to become opaque and friable. A test for pseudomucin but not for mucin was obtained by treating the gelatinous masses in the manner above described for the acidic fluid.

Since no case of pseudomyxoma of the peritoneum has been diagnosed prior to operation it seems well to call attention to the fact that the diagnosis may be made by an examination of the ascitic fluid. In cases of obscure ascites in women especially when a pelvic tumor is suspected or when there is a history of a previous pelvic operation, the examination of the fluid by the method outlined above would be of great value in arriving at a diagnosis. The test offers no technical difficulties and requires a relatively small amount of time. It must be remarked, however that difficulty might be encountered in collecting the fluid in some instances from the stoppage of the cannula by one of the gelatinous masses.

I wish to thank Dr J V Cooke under whose direction this work was done

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case of a seventeen-year-old girl who had a cartilaginous tumor of the knee-joint which contained a needle in its center. A case is reported by Morton (5) which had fifteen or sixteen tumors of the hand. While they did not interfere with its use the patient said that the slightest blow would cause another tumor to appear. Sick (9) mentions a case of multiple exostosis and enchondroma, explaining them as a congenital anomaly of growth which separated these cartilaginous islands and gave them a chance to develop. Cottbus (11) reports the case of a man fifty years old who received an injury to the top of his shoulder and later developed a rapidly growing cartilaginous tumor of the head of the humerus, a place which was not directly involved in the injury. Previous to the hurt this man had a small quiescent tumor in the same location, but several months later it started growing rapidly. The history of this case is given in detail and from it Cottbus reaches the conclusion that the whole bone having been at one time cartilaginous these islands have remained undeveloped and each island is a potential enchondroma which may develop into a tumor in the period of growth. He further believes that the impetus to renewed growth of enchondromata often arises from trauma of a trivial character and that in some instances it may act as the exciting cause in the development of malignant growths on the bases of preexisting enchondromata which had heretofore shown only benign characteristics. In the case cited Cottbus believes that the growth would never have increased had it not been for the blow even though the blow did not fall directly upon the part from which the growth originated. He thinks that trauma plays this stimulating rôle only when the conditions are such as he has described and the secondary influence of trauma in the appearance of these growths explains more satisfactorily the simultaneous appearance of enchondromata in various parts of the body or their development in the depths of the pelvis or skull. However practically all who have studied this question agree that there is a close relationship between trauma and other irritants and the development of enchondromata.



Fig. Microphotograph of section of tumor near the surface.

This belief based upon clinical observation, is further confirmed by Helmholtz (10) who in 1907 produced multiple chondromata experimentally by the injection of a solution of Sudan III and olive oil in the ear of a rabbit. After this mixture was injected the stellate connective-tissue cells multiplied very rapidly and then developed into nodules of typical hyaline cartilage. It was found impossible to predict which of these embryonic cells would develop into ordinary connective tissue and which into cartilage. He was also able to show definitely that these were not buds or offshoots from the normal cartilage of the ear but definite tumors developing in the new connective tissue arising on account of the stimulation caused by the Sudan III.

In regard to the relationship between the development of enchondromata and heredity there seems to be but little evidence. The two instances in which heredity may have had a bearing are one case reported by Marchand, who observed four or five cases in one family and another reported by Weber where the grandfather, father and daughter suffered from enchondromata and exostoses. However rickets might also account for their occurrence.



The photograph of the tumor after removal, showing the proximal surface

led his physicians to hope that this improvement indicated some retrograde changes in the tumor. The patient was kept under observation for two years without any change being noted in the other symptom. A case of enchondroma of the manubrium sterni causing pressure symptoms is reported by Richardson. This was successfully removed.

Enchondromata may be malignant and destroy tissue just as a true sarcoma. They may also spread to other structures (presumably by bud growing into the vein) and reproduce the same type of encapsulated tumor but without invading the surrounding tissues. Tumors which grow rapidly are most likely to recur. Cartilaginous tumors of the scapula have been supposed to be especially liable to undergo malignant change and Johnson (3) states that "The scapula is one of the locations where enchondromata undergo malignant changes. Hertzler suggests that Cartilaginous tumors about the shoulder should always be regarded with suspicion for usually they are combined with sarcomatous tissue and rapidly growing cartilaginous tumors should be regarded as malignant. Walder in 1881 collected twenty five cases of which number six suffered from recurrences. Buchanan in 1900 collected twenty five cases and two suffered

from recurrences, these two however being both included in Walder's tables.

Virchow (4) reports the case of a large cystic tumor twice removed from the scapula. The patient had many recurrences and finally came to autopsy. Walder reports the case of a woman twenty five years old who developed a tumor of the left scapula which in three months grew to be as large as an infant's head. Histologically it had the appearance of an ordinary enchondroma. There were 46 recurrences extending over seven years. She was free from recurrences two years following the last operation at which time the case was reported. The recurring tumors were cystic and gelatinous. Virchow also reports another malignant case arising from a rib. Following the operation the patient died of a facial erysipelas. The autopsy disclosed a number of tumors of the same type in the lungs and pleura.

In regard to the etiology of cartilaginous tumors, Virchow has shown that in the bones of adults islands of cartilaginous cells that have not ossified are still present and he has suggested that the occurrence of cartilaginous tumors is in many cases in direct relation to the pathological changes of rachitis and the subsequent process of ossification and growth which would tend to increase the irregularity and number of the cartilaginous elements remaining. These cartilaginous island or rests later develop into tumors if the proper stimulation be given. The tumors of the parotid and testicle are probably always due to embryological rests and in the case of the parotid the development of the cervical cleft provides a mechanism which would tend to leave islands of cartilaginous cells.

Trauma has long been accepted as an exciting or stimulating factor in the development of enchondromata. Mosbacher (16) quotes C. O. Weber as stating that in his statistical study of enchondromata a history of injury was obtained in fifty per cent of the cases where satisfactory records had been made. Ziegler and Virchow both emphasize the importance of traumatism by showing that the point where enchondromata usually appear are subject to almost constant irritation as, for instance the knee joint. Shaw reports a

pending on the position of the foot at the time of the trauma and the additional pulling tearing out stress of the capsular ligament tibiofibular posterior ligaments on the bone surface. These I have frequently observed in the last three years and have applied to them the term lipping fractures. If these fragments are not replaced although the astragalus may be situated quite perfectly anatomically and the fracture of either malleolus be but a mere split a great interference in function results. This is explained by the fact that callus is thrown out under this misplaced shell of bone shoved down in front of the ankle joint at some quarter of its circumfer-

put up in the proper position to meet the demands of the case. I find this condition mentioned by Robert Jones and his whole word on the subject can be profitably quoted.

I have frequently seen a wedge of bone knocked off the anterior and outer part of the lower end of the tibia. This may occur by itself or as a complication of a Pott's fracture. The detached fragment is liable to slip down a little and block dorsiflexion and therefore interfere with walking. The treatment in the first instance is to get the foot into extreme dorsiflexion thus pushing the fragment out of the way. If the foot is fixed in this position for a few days the condition will not recur.



Fig. A

Fig. B

Fig. C

Figs. A and B A bursting forward of the anterior edge of the tibia. Lipping fracture. The tibioposterior view gives no information of the serious condition.

Fig. C Complete fracture of internal malleolus alone. Astragalus pushed outwards. Little

ence which later by its presence and possible adherence to capsular ligament or the astragalus causes marked interference with full flexion or extension of the ankle joint and provokes much pain after use of the joint by mechanically impinging against the astragalus. Such ankles may show perfect alignment of malleoli and astragalus and yet be extremely painful after mild use. These lipping fragments should be searched for carefully both clinically and in the skilgram and replaced by hyperextension or hyperflexion at the time the fracture is set. If they cannot be reduced by manipulation I believe they should be nailed on in correct position through a small skin opening after which, if malleolar fracture is present the foot can be

In old standing cases the patient comes with a history of an injury to the ankle or of a fracture in that region and complains of pain over the front of the ankle joint. On inspection the foot seems rather fuller than its fellow in this region. The X-ray photograph shows some irregularity of outline chiefly due to limitation perostitis. The treatment is to operate removing the offending portion of bone and making sure that the foot can be completely dorsiflexed. If the patient declines operation then the only thing to be done is to raise the heel of the boot so that the front of the astragalus does not impinge on the front of the tibia when walking.

This study shows that displacement of the

Enchondromata of the bone occur most frequently in the young or in young adults. Virchow (14) in the analysis of ninety-four cases involving bone reports that one half developed before the second decade and almost one-third occurred in the first decade. The bones of the hand were most frequently involved during the first decade and other bones during the second and third decades. The order of frequency in which the various bones are involved is as follows:

1. The bones of the hand.
2. The hollow bones—tibia and femur in a similar ratio, fibula seldom.
3. The jaw, pelvic bones, and scapula.
4. The ribs, the skull bones (especially the occipital bone).
5. The vertebrae, sphenoid, and sternum, these being the least prone to develop them.

The growth of these tumors is almost entirely at the periphery either of the whole tumor or of lobular then at the peripheries of the lobules. Both the time of appearance and the method of their growth support the belief that there is a close connection between the ossification and growth of bone and the development of the tumors.

Enchondromata involving soft parts such as lymph gland, parotid or testicle occur later in life. Those depending upon the presence of cartilage such as develop in the knee-joints, may occur at any time and are particularly likely to be caused by injury, arthritis deformans, or allied conditions.

Sarcoma of bones also occurs largely during youth and early life. The involvement of scapula by sarcoma has been discussed by Rawling (7) who reports a case occurring in a child four years old. He collected twenty-three recorded cases of bone sarcomata occurring in children. Four of these involved the scapula, and none of them was saved by operation. These cases are all typical sarcomata, none of them being malignant enchondromata.

Surgical removal of these tumors is the only method of treatment, and in the case of the involvement of the scapula it resolves itself into the question of the dangers of a complete or partial excision. The first recorded case of complete avulsion of the arm and scapula with recovery is mentioned by

Buchanan (13). On August 15, 1773, a miller in this condition was brought to St. Thomas Hospital (London). His condition was due to an accident and he finally recovered from it. According to Simon (15) the operation for total extirpation of the scapula for a malignant growth was first performed in 1835 by Dixy Crosby. The patient died four years later from recurrences. In one hundred and twenty-two cases collected by Simon seventeen died as a direct result of the operation. In an analysis of one hundred and twenty-four operations of total extirpation of the scapula since the antiseptic era, Buchanan found a mortality of ten and one-half per cent. In one hundred and eighty-one cases, including those before the antiseptic era the mortality was sixteen per cent. In four cases where total excision was performed for enchondromata, one died from the operation and one died after eighteen months from a recurrence in the lung (Langenbeck case). In twenty-one cases where a partial excision had been performed for enchondroma of the scapula, six died as a result of the operation of the fifteen survivors there were no recurrences, though the amount of time when the cases were observed was not sufficient to preclude the possibility of malignancy. Those operated upon since the development of modern technique showed a mortality of nine per cent. Now that safer methods of operation are practiced the mortality would undoubtedly be less. Birmingham (2) reports a case of enchondromata occurring on the right scapula of a young man twenty-five years old. It had existed for twenty years. There was no history of traumatism. Upon excision the enchondroma weighed seventeen pounds. At the time of operation a portion of the scapula, with the glenoid cavity was left. The patient was well eight months after the operation.

The following is the author's case:

*History.* Patient aged 30 male white admitted to the hospital on June 5, 1901. He had always been robust. Seven years ago while at work the hay fork he was using in the right armpit was stuck into the axilla by a horse. From the handle of the fork that he was using he sustained some lacerations of the skin. The remainder of the scapula was left. He was well eight months after the operation.

noticed a small lump in the axilla. This lump was hard, of slow growth, and gave him no pain. Two years previous to his admission to the hospital it began to grow rapidly and the original mass was pushed forward under the pectoralis major. At the time the patient presented himself for treatment the tumor had become so heavy that he was unable to hold himself erect and leaned toward the left, his spine showing considerable curvature. His arm was freely movable, except in a downward position where the tumor interfered, although it had never caused any pressure or pain in his arm.

The examination showed the patient to be a well-nourished young man. The heart and lungs were normal; the hemoglobin was one hundred per cent; the urine negative. His right scapula was the seat of a tumor that was hard and elastic, with many prominences. Toward the angle of the scapula there was fluctuation (from degeneration). Large veins showed over the entire surface of the tumor but the skin was in good condition. The scapula was freely movable over the thorax. The arm was strong and free. The vertebral border of the scapula above the spine seemed uninvolved.

Under cocaine a small piece of the tumor was removed and frozen sections were made. It showed pure hyaline cartilage with a deposit of calcium salts. At the point where the blood vessels entered the tumor these were large in amount. The upper portion showed marked mucous degeneration. A test for the presence of chondroma (kindly made by Mr. Watson) showed its presence in very small amounts. It measured fourteen inches long by thirteen and one-half inches wide weighing after removal fourteen and one-quarter pounds.

The topography of the tumor and its relation to the surrounding structures were carefully studied before the operation. The tumor was removed by dissecting it free and dividing the scapula just below the spine. It was not necessary to open the

capsule of the joint and the entire glenoid cavity was saved. The muscles removed were the latissimus dorsi, the teres major and minor, the infraspinatus, and the greater part of the subscapularis. The trapezius and its nerve and the circumflex were divided. The serratus anterior was not disturbed. The patient left the hospital on the sixteenth day after the operation.

It has been six years since this tumor was removed and so far there has been no evidence of recurrence. The patient has good use of his arm, though in order to put it above his head it is necessary to give it swinging movement due to the loss of the use of the deltoid.

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Enchondromata of the bone occur most frequently in the young or in young adults. Virchow (14) in the analysis of ninety-four cases involving bone reports that one-half developed before the second decade and almost one-third occurred in the first decade. The bones of the hand were most frequently involved during the first decade and other bones during the second and third decades. The order of frequency in which the various bones are involved is as follows:

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The following is the author's case:

*History.* Patient aged 30, male, white, admitted to the hospital on June 5, 1908. He had always been robust. Seven years ago, while at work in the hay field, he was injured in the right arm by a sharp blow from the handle of the fork that he was using. The joint continued sore the remainder of the summer. The following fall he

juxt aortic, and mesenteric lymph nodes the liver stomach and diaphragm marked chylous ascites erosion of the lumbar vertebral arches of the left leg cloudy swelling and disseminated fatty changes of the liver and left kidney hyperplasia and passive hyperemia of the spleen healed operative scar in the abdominal wall.

The body is that of an emaciated young man, 7 years of age and 175 cm. length. The abdomen is markedly distended tense and fluctuates on palpation. There is a healed vertical scar, the umbilicus near the midline below the umbilicus.

On opening the thin abdominal wall there escaped approximately 6 to 10 liters of milky blood stained fluid. The under surface of the diaphragm is covered with innumerable nodules soft new growths varying in size from that of a split pea to hazelnut. They are soft of grayish white color and cut easily leaving a surface granular appearance. There are numerous similar nodules varying in size from 1 to 8 cm. in diameter on the under surface of the liver especially marked in the left lobe. Scattered nodules of like appearance are also present in the serous coat of the lesser curvature of the stomach in the mesentery of both the small bowel and the sigmoid, and in the glands about the bend of the pancreas. The linings of the superior mesenteric splenic and portal veins are smooth.

The left kidney is of normal size. Its capsular tension is the same. Its capsule stripped easily leaving a smooth surface and there are no alterations other than those recorded in the anatomical diagrams.

The right kidney measures 9 by 5 cm. weighs 375 gms. and is firmly adherent by fibrous connective tissue to the under surface of the right lobe of the liver and also to masses of irregularly colored retroperitoneal lymph nodes. The surface especially the upper three fourths is nodular. There are three distinct bulging masses, the largest of which is the size of fist and the smallest that of goose-egg. The greatly thickened capsule contains many tortuous engorged blood vessels. The upper part of the tumor is of bony hardness in some places and in others it crackles under pressure. On section (Fig. 2) only the lower one fourth of the mass is found to be kidney and this is separated from the tumor by narrow bands of dense fibrous connective tissue. The cortex and medulla are both preserved. The usual relation between the capsule and a few small isolated grayish granular foci of tumor is varying in size from 1 to 3 mm. diameter are found in this part of the kidney. The histologic characteristics will be taken up later.

The tumor proper which comprises the upper three fourths of the mass is irregularly separated into varying sized lobules by connective tissue trabeculae. In the upper part of the tumor these trabeculae are so small and thick that it is necessary to use a special sectioning technique. Scattered here and there but very few calcified trabeculae are irregular masses of necrotic and soft fibrillar



Fig. 2. Radiograph showing calcification in the tumor.

more tissue. There are also scattered regions of hemorrhage throughout the tumor thus giving it many colors. The necrotic areas are grayish white and the tumor tissue proper arises from grayish yellow to a pale reddish brown. In some places there are scattered dark reddish regions of hemorrhage. The reddish brown areas have a finely striated appearance and can be shelled out completely leaving a smooth glistening wall to the remaining cavity. The kidney pelvis although greatly distended is free from tumor tissue.

Secondary tumors (Fig. 3) involving the retroperitoneal lymph glands, are so extensive that they form one large mass, which is located anterior to the renal column and extends from a point on the level with the coeliac axis to the level of the urinary trigone below. It is 30 cm. in length, 1 cm. in breadth, and 4 to 8 cm. in thickness. It is so firmly adherent to the vertebral column that parts of the bodies of the vertebrae which are eroded have to be removed with the tumor. The aorta and the iliac mass are excluded and surrounded completely by this mass. Between the renal column inferior from the kidney being greatly narrowed as it does so. Inasmuch as permission to open the thorax could not be obtained, the diaphragm was opened and the heart and lungs were examined by palpation. No tumor was demonstrated in this limited

dissection. In the lower part of the primary tumor, the metastases are demonstrated in this limited



Fig. 7. A, area of calcification. B connective tissue septa. C metastatic nodules in parenchyma.

(Fig. 7) were of similar appearance and structure microscopically. There were branching and interlacing villous or papillary processes extending out and in many places completely filling cystlike spaces. These processes had definite fine connective tissue stalks, in which were many small capillaries. They consisted from one to six or more layers of low columnar and narrow cylindrical epithelial cells. The cells covering the villi were continuous with the lining of the cyst walls, which were of flat cuboidal type (Fig. 8). There were regions where the cells were closely massed together with only very small amounts of connective tissue or blood vessels, so that the villous characteristics were lost (Fig. 9). Here and there scattered throughout some of the sections, particularly in the metastatic tumors of the lymph-nodes, were cells with mitotic figures.



Fig. 8. Showing the extensive involvement of the retroperitoneal lymph glands.

There were also scattered deposits of blood pigment, regions of more recent hemorrhage and all stages of degenerative changes, even to calcification (Fig. 6). Even in the metastatic nodules were many small scattered foci of deposited lime salts. Some of the small cysts were filled with desquamated cells and lime salts. Frozen sections stained with Sudan III showed the presence of fat in varying amounts, irregularly distributed throughout the tumor.

Reported by	Case	Age	Sex	Histogenesis	Metastases	Stiff	Result	Autopsy	Time
J. Jansel	Klinik der Nervenkranke	34	12	M	Prostate	Yes	Frozen and histology	Yes	Revised
J. Jansel	Klinik der Nervenkranke	30	10	M	Prostate	Yes	None	Yes	Cured
J. Jansel	Klinik der Nervenkranke	31	10	M	Tubercular	Yes	None	Yes	Cured
J. Jansel	Klinik der Nervenkranke	31	17	M	Prostate	Yes	Right testis removed, removed, removed	Yes	Revised
Garrison	Tumors of Kidney	34	30	M	None	No	None	Yes	Revised
Lapinskas	Burg. Gynec. & Obst.	34	30	M	Prostate	Yes	Lower lung displacement, prostate	Yes	Cured
Kaplan	Ann. Surg. Phila. Soc.	34	43	M	None	No	None	Yes	Cured
Kamander	J. Am. M. Ass. Oct.	1920	37	None	None	No	None	Yes	Cured
Ordo	Deutsche Zeitsch. f. Ch.	35	38	F	Not noticed	Retroposterior lymph nodes		Yes	Revised
Schick	Vierteljahrsschr. Anat.	36	38	M	Adrenal, lung, lymph nodes, heart			Yes	Revised
Krausner and Mandy	Burg. Gynec. & Obst.	36	38	M	Yes	Yes	Liver, stomach, displacement, diaphragm and lymphatic glands	Yes	Cured

Discovered at autopsy

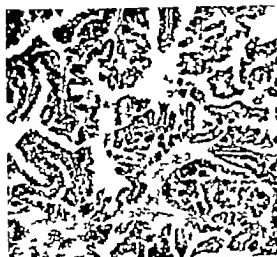


Fig 4 Showing cells covering villi. They are continuous with lining of cyst wall and are of the fibroblastic type.

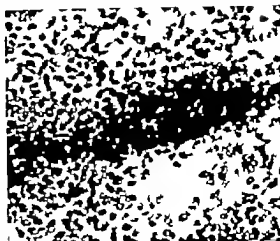


Fig 5 Showing cells massed together with small amounts of connective tissue or blood vessels. The villous characteristics are lost.

In a review of the literature we have found reports of some 75 cases of papillary tumors of the kidney arising from the pelvis. Although the tumor in our case resembles in some respects those of the pelvis and ureter we feel that any pelvic connection in this case is excluded because the pelvis was free from any tumor growth. Therefore our discussion must be confined to tumors arising within the kidney substance proper.

We have so far been able to find reported only ten cases which resemble the main characteristics of the tumor under discussion. These are briefly tumors arising from regions within the kidney parenchyma, having cystlike spaces into which project villous processes and which produce metastases of a similar character. In only one case that reported by Eisenstaedt were the metastases as extensive as in our case. All but one of the reported cases occurred in individuals over 40 years of age. Our patient was 17 years old.

Three of these cases were found at autopsy, namely those of Garceau, Grohe and Sudeck. The remaining seven cases were clinical, presenting symptoms from which the patient sought relief. Hematuria was the predominant symptom in seven cases. In Israel's third case the history of hematuria is indefi-

nite, the patient complaining of a swelling or a tumor in the side.

As regards sex, there were three females and eight males. The youngest patient was our case, aged 17; the oldest was that of Sudeck, aged 66. Between these figures, there was one aged 27, one 42, one 43, one 49, one 52, one 55, and one 58. All of the clinical cases had renal colic undoubtedly due to the passage of blood clots.

Another unusual feature is the enormous amount of lime salts present in the metastatic, as well as in the primary tumor. The cases reported in the literature contained none or only small amounts of such deposits.

This tumor, the malignant papillary cyst adenoma, is to be differentiated from the Grawitz tumor and the so-called Wilms tumor. In the Grawitz tumor of the adenopapillary type the cells are large and vacuolated and they form columns rather than cysts. The Grawitz tumors have a great tendency to invade the renal vein, whereas in our case the veins were unaltered. This case differs from a Wilms tumor in that it did not contain bone, muscle or cartilage, although in the gross and especially from the X-ray plates, a Wilms tumor was suspected.

*Metastases.* Metastases were present in all of the cases coming to autopsy (except



Fig. 6 Showing areas of calcification in the metastases



Fig. 7 Histological section of metastatic nodule in laryngeal parathyroidoma marked (C) in Fig. 1

Garceau?) No metastases were recorded in two of Israel's cases and in the case of Squier and Shoemaker. The time elapsing between the operation and the time of reporting the cases, perhaps, has been too short and subsequent reports of these may show metastases later on.

Regarding exciting factors in the production of the haematuria the following were mentioned:

Fall on the ice (Israel)

Followed heavy marching (Israel)

After vomiting and sea sickness (Israel)

Strain after heavy lifting (Moody and Kretschmer)

**Diagnosis.** The clinical diagnosis must always remain that of renal neoplasm which was comparatively easy in this case when the patient first came under our observation. Of greater difficulty was the determination of the type of new-growth under consideration. This was somewhat obscured by the X-ray findings, which showed the presence of a round, trabeculated structure in the region of the kidney. Fluoroscopy demonstrated that

the shadow producing body was below the diaphragm.

The enormous size of the tumor, the age of the patient, and the presence of this apparent bony shadow led us to believe that we were dealing with a mixed tumor of Wilms. The persistent profuse haematuria, however, was not consistent with this diagnosis, for as a rule these mixed tumors do not produce haematuria.

For the purpose of further elucidation regarding the rigid and possible nature of this apparent bony shadow pyelography was carried out. This failed to demonstrate the presence of fluid within the bony shadow because of the absence of any connection between it and the pelvis.

**Origin of tumor.** From the description of the gross specimen it is self-evident that this tumor had its origin in the upper half of the kidney. Because of the presence of extensive calcification and degeneration in the upper part of the tumor we believe it to be the oldest part, and therefore it had its origin in the region of the upper pole of the kidney.

**Pathogenesis.** Various explanations have

been put forth from time to time to determine the origin of various epithelial tumors of the kidney. According to Dunn aberrant epithelial structures fall into three groups, namely:

1. Rests of suprarenal tissue
2. Adenopapillary tissue.
3. Papilliferous cysts

He believes that the latter two take their origin from the kidney tubules, basing his conclusions on the fact that he was able to demonstrate with microscopic sections a communication between the cysts and the convoluted tubules. These changes were found in kidneys showing chronic inflammatory changes and in individuals averaging 55 years of age. Of general clinical interest is the statement in the history that the patient had a profuse hæmaturia with his attack of typhoid fever at the age of 9. The origin of this hæmaturia might have been due to a toxic nephritis associated with his typhoid, or it might have been due to the typhoid bacillus.

This brings up the question of whether or not the neoplasm was present at that time and suggests that possibly the hæmaturia at this time was due to its presence. This fact cannot be definitely determined, but it is reasonable to assume that the tumor did not cause the hæmaturia at the time of his typhoid. Of significance in this connection is the long interval between the first hæmaturia and the onset of his last illness (6 years) and the duration of his last complaint (1½ years) during which time there was a very

rapid growth of the tumor as well as its metastases.

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 1



Fig 6 Showing areas of calcification in the metastases

Garceau<sup>2</sup>) No metastases were recorded in two of Israel's cases and in the case of Squier and Shoemaker. The time elapsing between the operation and the time of reporting the cases, perhaps, has been too short, and subsequent reports of these may show metastases later on.

Regarding exciting factors in the production of the hematuria, the following were mentioned:

- Fall on the ice (Israel)
- Followed heavy marching (Israel)
- After vomiting and sea sickness (Israel)
- Strain after heavy lifting (Moody and Kretschmer)

**Diagnosis** The clinical diagnosis must always remain that of renal neoplasm, which was comparatively easy in this case when the patient first came under our observation. Of greater difficulty was the determination of the type of new-growth under consideration. This was somewhat obscured by the X-ray findings, which showed the presence of a round, trabeculated structure in the region of the kidney. Fluoroscopy demonstrated that



Fig 7 Histological section of metastatic nodule in kidney parenchyma marked (C) in Fig

the shadow producing body was below the diaphragm.

The enormous size of the tumor, the age of the patient and the presence of this apparent bony shadow led us to believe that we were dealing with a mixed tumor of Wilms. The persistent profuse hematuria, however, was not consistent with this diagnosis, for as a rule, these mixed tumors do not produce hematuria.

For the purpose of further elucidation regarding the origin and possible nature of this apparent bony shadow pyelography was carried out. This failed to demonstrate the presence of fluid within the bony shadow, because of the absence of any connection between it and the pelvis.

**Origin of tumor** From the description of the gross specimen it is self evident that this tumor had its origin in the upper half of the kidney. Because of the presence of extensive calcification and degeneration in the upper part of the tumor we believe it to be the oldest part, and therefore it had its origin in the region of the upper pole of the kidney.

**Pathogenesis** Various explanations have

geon, devised a method whereby he introduced into a small flask, the end of which had been drawn to a fine capillary tube, definite amounts of culture media and antiseptic solutions. The end of the tube was then sealed by heat and the flask sterilized by prolonged boiling. The seal was broken, the organisms introduced from other similar flasks, and the inoculated flasks incubated for growth. Rideal and Walker (6) in 1903 used the "drop method," which was merely a modification of Sternberg's plan. They added a small but definite amount of standard cultures of standard age to equal volumes of various antiseptics and then plated from these dilutions.

Post and Nicoll (7) modified the last method, using the following technique. One half cubic centimeter of the solution to be tested was placed in a small test tube and to this was added a platinum loopful of bouillon emulsion of a 24 hour blood-agar growth of organisms. At intervals of one, ten and thirty minutes, and twenty four hours, a loop of contaminated test solution was thoroughly mixed in a tube of blood agar and plated. After twenty four hours' incubation the number of colonies was counted and tabulated.

None of the methods hitherto described of which the above are fairly typical is applicable in estimating the efficiency of an antiseptic in the surgical problems of skin disinfection preparatory to operation, or their use in infected wounds, abscess cavities, etc. The methods are of undoubted value in determining that a drug has antiseptic value and to a certain extent, in determining the relative antiseptic power of various drugs and chemicals. But even though a certain reaction takes place *in vitro* under ideal conditions, we have no right to assume that similar reactions occur when dealing with dead or living animal membranes. Unfortunately in the practical application of antiseptics, organisms must be treated as they lie buried in the deeper layers of the skin or surrounded by necrotic cells or body secretion, more or less protected from the action of the antiseptic.

Accordingly when Seelig and Gould (1) published the results of a series of experiments

under the title "Osmosis, an Important Factor in the Action of Bacteria, confining themselves chiefly to the problem of skin disinfection, and arguing that to reach the bacteria a germicide must penetrate the deeper layers of the skin, their results seemed to indicate that at last a method had been devised which would satisfy the conditions to be met in the practical application of germicides. Maillard (8) had already stated that all experiments thus far err in that osmosis is ignored and Eckhardt is quoted as stating that the diffusion velocity of an antiseptic is directly parallel to its germicidal effects. Based upon these and other observations Seelig and Gould devised a technique which approaches the conditions met in practice for it takes into account osmosis, a factor hitherto disregarded in testing the relative germicidal power of different antiseptics.

Their views were tested in two series of experiments, one using celloidin capsules for the semipermeable membrane, and the other by the employment of dead and living animal membranes. Their capsules were made according to a modification of the Harris method. Half a gelatin capsule is fitted over the end of a glass tube and sealed to the tube. This is dipped in celloidin, which is allowed to harden, then the gelatin is dissolved in hot water leaving a celloidin bag fitted to the end of a glass tube. Bouillon cultures of various organisms were placed inside the capsules and the whole suspended in the antiseptic solution. Loopfuls of bouillon were removed from the capsules, at intervals of from ten minutes to twenty four hours, and plated on agar.

Where living animal membranes were used the conditions were much more severe than those encountered in the operating room but the results reported were encouraging, and it seemed that by applying such a rigorous test any conclusions regarding the efficiency of an antiseptic would certainly be true. They dissected off a large skin flap from the shaved abdomen of a rabbit, and having turned it back, fur side down, pouched it into a small vessel by means of a glass depressing rod. Into the upper or visceral, layer of the flap thus pouched they poured pure bouillon cul-

# A STUDY OF THE EFFICIENCY OF THE SEELIG-GOULD METHOD OF TESTING ANTISEPTIC SOLUTIONS<sup>1</sup>

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UNTIL the publication of a recent paper by Seelig and Gould (1) no satisfactory method appeared to have been devised to test the efficiency of antiseptic solutions under conditions which at all approached those used in ordinary surgical procedures. That the various methods hitherto employed all are open to some criticism will be pointed out in a brief review of the more important literature. Their suggestion of employing living animal membranes seemed so promising from the results given in their paper that, even though the conditions of the experiment were much more rigorous than would be actually demanded of an antiseptic under clinical conditions, it was deemed advisable to repeat and extend their observations by testing most of the common antiseptics employed in surgery. Accordingly the following research was undertaken.

Before discussing the method and its application in detail, however, it may be well to review briefly the various means that have been employed previously. Of the numerous suggestions, the following may be selected as being the most important and typical.

Koch (2) in 1881 used what has been termed the "thread method." He immersed a thread in a bouillon culture of the organisms to be tested, and after allowing sufficient time for its thorough impregnation, removed the thread and dried it. Next it was suspended in a germicidal solution and the length of time taken to kill the organisms determined by making plants on agar from the thread. This technique was open to criticism on two grounds: *first* that the vitality of the organisms might be diminished by the denaturation and *second* that a certain amount of the antiseptic would infiltrate the thread and continue to act for a longer time than his data would indicate.

Two years later Miguel (3) announced that he would treat the subject in a more general manner by making known simply the mini-

mum weight of the substances capable of preventing the evolution of any bacteria or germs. To accomplish this he added to a standard culture media a known weight of the antiseptic and a mixed culture of organisms obtained from the dust of a dwelling house or hospital, or from sewage. Obviously Miguel's treatment of the problem is at fault in not recognizing the particular kind of bacteria with which he deals, their individual resistance to germicides, or the possible results of symbiosis.

In 1879 Paul and Kronig (4) two physical chemists, discussed the subject in strict accordance with physicochemical principles emphasizing three factors which must be kept constant: i.e. the number and species of the organisms, the temperature, and the media (which must be free from organic material). They took chemically clean garnets and coated them with an agar emulsion of bacillus anthracis or staphylococcus. These were then dried twelve hours at 7° C. Next the coated garnets were placed in platinum sieves and hung in germicidal solutions at 18° C. for varying periods of time. The reaction was stopped by washing in water and chemically neutralizing the germicide, and the garnets were again washed by shaking in water. They were heated to 37.5° C. and mixed with agar from which plates were poured. They concluded—

1. That the number of colonies obtained was dependent upon the time of reaction and the molecular concentration of the antiseptic solution.

2. That the germicidal action of acid solutions is parallel to the degree of dissociation i.e. the number of free H-ions in the unit volume of solution. The anions and undissociated molecules have germicidal action but this is insignificant.

3. That the action of a base is parallel to the free OH-ion in unit volume of solution.

Sternberg (5) a United States Army sur-

<sup>1</sup>This paper is an abstract of a thesis presented for the degree of Doctor of Medicine, Yale University.

**I Bichloride of mercury solutions** Bichloride of mercury in dilutions of 1:500, 1:1,000, 1:2,000, and 1:5,000 were used. Harrington's solution as has been considered here. In the first series all the solutions showed effective germicidal action in one minute with the exception of the 1:5,000 dilution of  $HgCl_2$  which killed in five minutes. In two controls, however, none of the solutions was effective in one minute nor in two minutes with the exception of Harrington's solution in one instance. Bichloride 1:1,000 was only effective in fifteen minutes while in dilution of 1:5,000 the organisms were killed in thirty minutes. Harrington's solution which was so efficient in the original test showed wide variation in the controls, in one instance taking effect in five minutes and again there was inhibition in twenty-five minutes.

**II Silver salt and compounds** Here are included silver nitrate in strengths varying from 5 per cent to 1 per cent, together with argyrol 0.5 per cent and protargol 0.5 per cent.

Again we would call attention to the wide variation in the results. One half per cent  $AgNO_3$  in no instance would effectively penetrate the celluloid even when allowed to act for a period of three hours. The one per cent solution was likewise inefficient except in one instance when the plant made one hour was sterile. Two per cent  $AgNO_3$  showed considerable variation; once there was complete inhibition in ten minutes, while in a second instance the organisms were still alive and showed only slight inhibition after three hours. One per cent solutions of silver nitrate showed germicidal action in fifteen to twenty minutes. The organic silver preparations, argyrol and protargol, each at 0.5 per cent strength, were in no case able to penetrate the membranes effectively.

Thinking that possibly the marked failure to take effect of such an excellent antiseptic as silver nitrate was due to the presence of the foods in chlorides in which the organisms were suspended and the consequent formation of inert  $AgCl$  aqueous suspension of bacillus pyocyanus was substituted. The results however did not justify this conclusion. One half per cent and two per cent  $AgNO_3$  were not effective in two hours while the one per cent solution which had killed the organisms in saline suspension in one hour was not present in sufficient concentration to act in ten minutes. This anomalous result may be due to undiscovered leakage in the capsule. Ten per cent  $AgNO_3$  was effective in one hour. Without doubt the concentration of the saline was so much less than that of the silver salt that only a small amount of  $AgCl$  was present to hinder the reaction.

To determine how soon the silver would actually penetrate the saline in the capsules a series of chemical tests was made using 0.5 per cent sodium chloride inside the membranes and the above mentioned strengths of silver salts in the container. The time when the white  $AgCl$  appeared either inside or outside the capsules was noted. Diffusion

took place in both directions and in eighteen hours the systems were practically all in equilibrium, but the intermediate stages were as important as many of the results already noted on the bacterial suspensions. No conclusions can be drawn from these observations aside from the fact that osmosis does take place.

**III Phenol solutions** This series consisted of 5 per cent phenol in water, 5 per cent phenol in 8 per cent saline, camphor and phenol (1:3) and 98 per cent phenol. Phenol in saline was used, as it has been shown that the presence of sodium ions increases the penetrability of this germicide. Camphor and phenol has been extensively used in veterinary surgery under the trade name of Camphor Phenique and has been lately introduced in some clinics for use in human surgery. It is prepared by rubbing in a mortar one part of gum camphor with three parts of phenol crystals which forms thick syrupy liquid. As control for the last mentioned antiseptic, phenol crystals were rubbed with just enough water to make thick syrup.

A 5 per cent aqueous solution of phenol was effective once in fifteen minutes, again in two hours and the third time at in twenty-five minutes beyond which time this control was not extended. A 5 per cent saline phenol solution showed no increase in diffusion velocity over the aqueous solution and the variation was as marked as with the latter. The camphor and phenol was a trifle better than the strong phenol alone. In the first experiment both were effective in ten minutes in controls, neither showed germicidal action in twenty-five minutes but in third control the strong phenol gave results in ten minutes while the camphor and phenol was effective only in twenty-four hours.

**IV Miscellaneous solutions** Peroxide of hydrogen was very slow to penetrate the capsules although the effects happened to be constant in two tests. This germicide was present in sufficient concentration to kill the organisms in forty-five minutes.

Aluminum acetate which is quite extensively used in our clinics as a wet dressing, was found to have no germicidal action in twenty-four hours.

Lake's balaam of Peru failed to show any such effect but even though it should have antiseptic action the fact that it consists of a large number of substances, many of which are colloids would probably prevent its complete diffusion through colloidal membrane.

An attempt was made to contrast the action of aqueous and alcoholic solutions of iodine in bacillus typhosus. The official tincture of iodine penetrated in one minute and no growths were obtained. When this was controlled by placing starch solution inside one of the capsules, the starch reaction was obtained in one minute. The alcoholic solution was contrasted with an aqueous iodine solution containing 1.7 gm. KI.

In the same year Quénu reported 15 cases as follows:

- 1 posterior margin of the tibia alone
- 2 accompanied by malleolar fractures
- 3 accompanied by fracture of the upper end of the fibula

Stimson considers the lipping break of the tibia as complication of Pott's fracture and in 1908 had never seen a recent case—all being old. He raised the fragment in two cases, corrected the displacement and obtained a useful foot. In one he removed the articular surface of the tibia, leveled off the astragalus getting a bony union with a good result

now not meeting with resistance comes against the lip of the posterior articular surface and chips it off. This is very plausible but does not explain cases of isolated fracture of the posterior or anterior lip. Fracture of the posterior lip alone has been considered very rare. Quénu find but three to which he add a fourth and Plagenmann mentions finding but two cases in eighteen years of practice.

Examination generally shows painful extension or flexion and an anteroposterior skigram may show no trace of fracture but the lateral view shows the lines in the tibia



Fig 6 A

Fig 6 B

Fig 7 A

Fig 7 B

Figs 6 A and 6 B Bimalleolar fracture astragalus popped out and too posteriorly. Note lateral malleolus pulled clear down under joint surface.

Figs 7 A and 7 B Repair of fracture shown in Fig

6 B by pulling. Note astragalus in proper right bearing in reference to tibia, also pulled forward in proper position and malleoli backed on. Here they belong. Clips in place.

From the prognostic standpoint the lipping fracture is a lesion of the greatest importance and in old cases the advisability of recourse to operation is imperative. Formerly no recent cases of this type of fracture were reported nor treated with this point in mind—they are now coming into the literature.

**Mechanism.** Most all are caused by slipping or a fall with the foot in hyperextension and often abducted and a tearing out of the articular border of the tibia by the posterior articular and tibiofibular ligament accompanied by a crushing force upward and backward transmitted by the astragalus. The theory is further advanced that after fracture of the fibula a continuation of the line of force

Clinically it is quite impossible to obtain a point of extreme local tenderness over these isolated lipping fractures or to obtain crepitation but in a so called Pott's fracture with marked posterior displacement of the foot and the absence of injury or deformity in the tarsal bones one should suspect these breaks. Without a skigram and where the lipping fracture exists with little displacement of its fragment one may rely partly on the presence of an extended ecchymosis along the posterior surface of the ankle or a point of extreme tenderness or pressure under the tendo achillis in the depression back of the malleoli. The amount of displacement of the foot seems to give no key as to the possibility of lipping

containing bacillus typhosus streptococcus, staphylococcus, and bacillus prodigiosus, inhibitory effect was noted in forty five minutes, nor did the addition of 5 per cent acetic acid show any accelerating effect on its diffusion velocity. These tests were all adequately controlled and in only single instance was a negative culture obtained.

In a series similar to the one just described, dead membranes were substituted. These were taken from animals which had died during the induction of anesthesia. The organisms were killed in periods varying from five to ten minutes but one organism (bacillus prodigiosus) never gave negative plants. The reaction between the mercury and protein may perhaps be hastened by death, by the mechanical factor of lack of removal by the circulation already mentioned, or by the toxic effect of an overdose of ether vapor in solution in the tissue,—any or all of these factors might explain the accelerated antiseptic action of bichloride on the dead membrane.

A 1:1000 solution of iodine (commercial benzene in one instance) immediately penetrated the living membrane, but control with the so called petroleum ether failed. Whether the latter is lacking in penetrating power or whether the method is at fault we are not prepared to say but its very rate of effective action was observed in one hour. This solution was also tried with dead membrane from a rat which had died thirty minutes previously during the induction of anesthesia. For streptococcus and staphylococcus, the mixture showing marked affinity as germicidal action took place in five minutes but on bacillus typhosus and bacillus prodigiosus it had no effect in thirty minutes. This selects a action for the typhococci with dead animal membrane was apparently of an accident for in other instances using other antiseptics the cocci were killed while the bacilli were unharmed.

The other antiseptics tried—namely one per cent picric acid in acetone, camphor and phenol (1%) tincture of iodine (U. S. P.) and an aqueous solution of gentian violet—also showed no bactericidal effect within the time of observation. Gentian violet, which Churchman (1) has shown to be such an efficient germicide as it is undoubtedly changed by the animal tissues so that it loses its germicidal properties. Tincture of iodine which is so efficient clinically and also with the celloidin capsule showed surprising inability to penetrate the superficial skin layers and act upon the bacteria contained in the subcutaneous pouches.

These results would hardly recommend the method as an efficient test of an antiseptic acting upon the skin. The series of experiments was large enough to eliminate a faulty technique. That osmosis does take place cannot be denied but that it can take place within three minutes, as reported by the authors of the method, is extremely doubtful. In these experiments it was found that

periods of one hour or in many instances longer were necessary for effective penetration and this is of course too long to parallel clinical conditions.

The skin flap method for testing the efficiency of an antiseptic is inadequate for the following reasons:

1. The conditions in the living skin flap do not parallel those in the celloidin membrane and no analogies between them can be drawn. Many phenomena of the living skin are not reproduced in an artificial membrane.

2. We have found it impossible to control the thickness of both animal and artificial membranes.

3. After varying periods of time the circulation in the living flap is arrested and then the membrane no longer exhibits characteristics of a viable flap.

4. It is difficult to obtain an even distribution of organisms so that all parts of the suspension are simultaneously affected. Although the authors of the "skin-flap method" are not explicit upon this point we infer that they pour several cubic centimeters of bacterial suspension into the skin pouch. Only those organisms consequently in immediate contact with the membrane would be affected by the solution or at least not until the reaction had continued for some time and the diffusing solutions were approaching equilibrium. This objection would certainly apply to the celloidin capsules in which 2 ccm. of saline suspension were used.

5. The time of reaction is not a trustworthy standard of comparison, as in properly controlled observations we cannot demonstrate that it is a constant factor.

In the present state of our knowledge, the efficiency of an antiseptic cannot be attributed solely to physicochemical conditions such as the concentration of the antiseptic solution, its solvent power upon the membrane, or its osmotic tension. Probably the character of the living and dead animal membranes largely determines the rate of diffusion as does also the thickness of the artificial celloidin membranes. Thus far no method has been devised which determines the comparative efficiency of antiseptic solutions under conditions obtaining in a modern operating room.

ture of the organism to be tested and in the vessel below placed a solution of antiseptic. Loopsful were withdrawn from the culture in the pouch at varying intervals and planted on agar. Their results indicated that osmosis took place between the two fluids for after periods of time varying with the antiseptic and the membrane employed the agar plants no longer showed growth, and in certain instances chemical tests were made to demonstrate the presence of the antiseptic inside the pouch.

In brief their conclusions were as follows:

1. With celluloid capsules, iodine (12.5 per cent in water and K.I.) alone of all the solutions tried would penetrate the contained bouillon culture in twenty five minutes and prevent the growth of organisms. The actual presence of iodine was shown by the starch test.

2. With celluloid capsules alcohol in the higher strengths penetrated with remarkable rapidity, no perceptible increase in antiseptic efficiency being observed above 95 per cent but below 95 per cent alcohol is effective in proportion to the percentage strength.

3. With the exception of iodine substances dissolved in alcohol showed no increase in efficiency over alcohol alone where celluloid capsules were used.

4. Tincture of iodine penetrated the celluloid and killed even more rapidly than strong alcohol.

5. The above conclusions were all verified on animal membranes.

6. Bichloride of mercury 1:5,000 was ineffectual with all membranes while a dilution of 1:1,000 penetrated and killed in forty five minutes.

7. Phenol five per cent effectually penetrated animal membranes in three minutes though it failed with celluloid.

Since Seelig and Gould were able to report such definite results with their technique it seemed desirable to repeat and extend their experiments. However this technique was somewhat modified by me after a few attempts.

Although the problem of osmosis properly lies in the field of physical chemistry nevertheless the problems to be solved in this par-

ticular instance are of clinical rather than of pure scientific interest. Consequently it is perhaps justifiable to use the method as described by its authors, under conditions which do not fulfill all of the requirements of a rigidly conducted physicochemical experiment.

The following series of experiments were performed in the surgical laboratory of Yale University and all cultures were obtained from the stock of the bacteriological laboratory. All experiments were made with twenty-four hour cultures unless otherwise noted.

#### TECHNIQUE

In the first series celluloid capsules were employed. These were made as follows: An eight per cent solution of celluloid in equal parts of absolute alcohol and ether was poured at a large clean test tube and then allowed to drain until a thin even layer remained on the inside of the tube. The latter was filled with cold water and allowed to stand a few minutes until the celluloid was thoroughly hardened. With a sharp knife the excess was pared away from the top of the tube, and then the capsule was gently dissected off by flowing a bubble of air to come between the glass and the membrane. The capsules were stored in water to prevent drying and cracking, and as needed their open ends were sealed in glass test tubes with celluloid.

A series of these tubes fitted with celluloid bags was suspended in a rack and a each tube was placed 3 ccm. of a saline suspension of age growth of organisms. These were allowed to stand for at least ten minutes to be certain that there were no pin point leaks as indicated by drops collecting at the bottom of the capsule. In the meantime small staining-dishes were filled with known antiseptic solutions. Then the rack was picked up and the capsules lowered simultaneously into the solutions.

At intervals, loopsful of the contained cultures were withdrawn and planted on agar slants which were incubated and observed after twenty four hours. In preparing these bacterial emulsions the growth from twenty four hour agar cultures are added into 30 ccm. of normal saline and then vigorously shaken to break up any clumps of organisms. In all of this series bacillus pyocyaneus was used, as the pigmentation offered a ready and rapid means of detecting growth.

IN OBTAINING BY THE CELLULOSE CAPSULE METHOD OR EMPLOYING VARIOUS ANTISEPTICS IN CONCENTRATIONS ORDINARILY USED IN SURGERY

The antiseptics selected for these in common use as far as possible the conditions have been kept constant in all the experiments. The control solutions were taken from the same stock solution as used in the original tests. The time required to kill the organisms is the standard of comparison.

# DEPARTMENT OF TECHNIQUE

## A NEW METHOD OF ROUND LIGAMENT FIXATION

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In the hope of interesting surgeons sufficiently to give it a trial and to press their opinions as to its worth I wish to describe an operation I recently devised and performed for fixation of the round ligaments. Several surgeons to whom I explained it expressed very favorable opinions in regard to it and on the method in two cases of his own. It is so simple that the student can be described in a few words.

The incision is opened in the usual way, the round ligament separated and by means of a ligature carrier which has been thrust through the rectus muscle, drawn to the surface of that muscle. Thus far the operation is similar to that of Montgomery's. At this stage, however, it differs and it is this difference which causes good results to be more permanent. Instead of tightening the loop of round ligament to the small open

ing made in bringing it through the rectus by the ligature carrier it is held up by an assistant and the surgeon either with scissors or scalpel commencing at the site where the ligament has been drawn through, cuts for about three quarters of an inch in length in the direction of the fibers and towards the pubis the rectus muscle and underlying tissues, including the peritoneum. The assistant then holds at the upper angle of this incision one end of the loop of round ligament and pillars and holds the other side in the lower angle. While so held it will be observed that the loop arches over the incision made in the rectus, one pillar being in the upper the other in the lower angle. The surgeon working under this arch sutures together with catgut the edges of the incision in the rectus lying between the pillars held; the upper and lower angle being careful

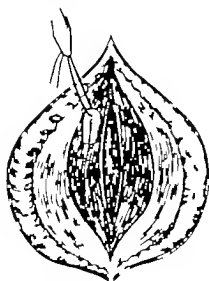


Fig. 1. Round ligament after having been drawn through rectus muscle is held up by assistant. Bulk over grooves rectus and underlying tissues.

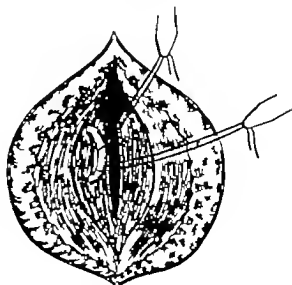


Fig. 2. Round ligament held in new position by assistant while surgeon sutures the incision in rectus and underlying tissues.

5 gm.  $H_2O$  100 ccm and the results were identical with the former test .95 per cent alcohol effectively penetrated in ten minutes

It needs but a hasty glance at these results to see that they are far from constant and fall far short of the well tabulated values given in the report of the originators of the method. It is true that many of the antiseptics killed the organisms by diffusing through the membranes when allowed to act for a sufficiently long time but this time varied greatly. Evidently some factor in the experiment was inconstant. This was not the solutions, for both the antiseptic and the bacterial suspension were from the same stock. The organisms were all from twenty four hour agar slants grown at constant temperature the suspensions were made in the same manner and the amount of suspension accurately measured. The temperature of the room was probably fairly constant. The thickness of the capsule however could not be accurately measured. The membranes were made from the same celloidin stock, but it is very probable that the amount of celloidin adherent to the mould varied beyond control. Seelig and Gould recognized this possibility and give data to show the effects of thick and thin capsules on the diffusion velocity. Abel (9) states that the thickness of the celloidin has no effect upon the rate of diffusion, but his observations were made with moving fluid. He says, however that there is a layer of stasis next to the membrane which keeps this factor constant. Moreover his observations were made hourly and possibly the diffusion velocity would vary within the limits of an hour. At least we are forced to ascribe the inconstancy of our results to the lack of uniformity in the thickness of the capsules or to differences in the resistance of the organisms.

The following conclusions may be drawn concerning the method as we have employed it:

1. Osmosis does take place between fluids using celloidin as a semipermeable membrane.
2. If allowed to act for a sufficiently long time most antiseptics of a crystalline nature will penetrate and kill organisms.
3. The time of reaction is not a suitable standard of comparison for the value of an

antiseptic unless all the experimental factors can be kept constant.

4. We have found it practically impossible to keep the thickness of the celloidin membranes and possibly the temperature constant.

5. The conclusions of Seelig and Gould are open to criticism in that they did not sufficiently control their experiments, regarding a single observation as conclusive.

As the experiments were undertaken to demonstrate the comparative efficiency of antiseptics acting upon the skin we also tried a limited number of experiments using living animal membranes according to the technique described by Seelig and Gould.

In all our experiments rats were used, as they are cheaper and more easily handled than rabbits. After a few preliminary tests with the whole thickness of skin and fascia, it was found necessary to make small pockets in the membrane having for their floor the superficial skin layers only as the first membranes were too thick to allow rapid osmosis. Into these pockets a thick emulsion of organisms from the water of condensation of agar slants was rubbed and the whole membrane depressed by means of a glass slide into a container of antiseptic solution as already described.

To be sure that our membranes were actually alive the circulation was tested at frequent intervals. This point is of particular importance as it was shown by a series of tests that diffusion takes place much more rapidly through dead than living membranes. Whether this is due to the mechanical removal of the antiseptic ions by the circulating blood and lymph or whether it is due to some property of living cells, or to both factors combined, need not here be considered. Suffice to say in many of our flaps there was practically no circulation in so short a time as forty minutes. Accordingly unless conditions are ideal so far as the circulation in the flap is concerned, no satisfactory conclusions can be drawn when the antiseptics are allowed to act for periods longer than forty minutes.

*Data on living membranes:* When bichloride of mercury in dilutions of 500 and 1,000 was allowed to act through living membrane on pockets

## THYMIC ASTHMA SUCCESSFULLY TREATED BY X-RAYS

## REPORT OF TWO CASES

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TO the small number of cases of thymic asthma reported as successfully treated by X rays we wish to add the two following believing that such treatment skillfully administered should be more generally employed. The roentgenograms showing the reduction in the size of the gland following treatment are we believe unique.

**CASE 1.** Zoe C. age 30 refs. sent in for admission to Maternity and Children Hospital Dec. mb. 7, 1919. Only history obtainable noted that she as a seven months child, has had colds and sniffles since birth and two attacks of wheezing and strapping cough and dyspnea during the last month. Her voice is clear during sleep the difficulty in breathing is less. When picked up or when exposed to cold the difficulty is greater. She has difficulty in swallowing.

**Examination.** Weight 74 lbs. Has no sufficient attack face blue respiration 30 in. rhed respiratory stridor with slight cough. Nose throat in and ears

normal. Auscultation rattling wheezing and heezing, fine and coarse mucous rales over whole chest, front and back. Breathing resembles the noise of boiling water. While listening breath sounds stop for a few seconds, then as is heard to enter. There is sinking in of suprasternal and sub-sternal region on inspiration and wheezing continues bulging of anterior fontanelle. Percussion over chest, normal. Heart action on no abnormalities. Percussion over thymus shows right border 1 centimeter to right of sternal border at level of second rib. Left border at left sternal margin. Thymic dullness below emerges into that of heart. These findings confirmed later by roentgenogram by Mr. Dachtler (Plat. 1). Other physical findings negative.

**Diagnosis.** Adenoid, enlarged bronchial glands, and other causes of laryngeal stenosis being excluded diagnosis of thymic asthma is made.

On December 24, 1919, first treatment by exposure to X rays after which she seemed more distressed and refused food but improvement in breathing noticed the next day. December 26th. Second treatment. After effect not so noticeable but once a feeble cry. December 27th. Third treatment. X longer continuously crawled breathing much easier. Suffocative attack, which has occurred at seven times in twenty four hours, occurred only once yesterday. This and preceding treatment given at distance of 1 cm. inches through leather filter only—one Hobbins unit each. December 28th. Fourth treatment one half Hobbins unit. Almost no thymic suffocative attacks (night) only been exposed to cold. Almost complete aphonia. Examination shows



Plat. One. Thymus enlarged the right



Plat. Case Six. X ray exposures. Absence of thymic hypertrophy

There is reason to believe that several of these factors are at work either singly or in combination, to produce the antiseptic effect. Moreover it is quite probable that the selective action of the bacterial protoplasm for a particular antiseptic may play an important rôle in this problem as has been beautifully demonstrated by the action of gentian violet and dahlia for a particular group of organisms, or by the affinity of cal varson for the *treponema pallida*.

In conclusion I wish to thank Prof J M Flint for many helpful and valuable suggestions in these experiments.

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## THYMIC ASTHMA SUCCESSFULLY TREATED BY X-RAYS

## REPORT OF TWO CASES

R. H. J. MORGAN, M.D.

H. W. DACHTLER, Toledo, Ohio

TO the small number of cases of thymic asthma reported as successfully treated by X-rays we wish to add the two following believing that such treatment skillfully administered should be more generally employed. The roentgenograms showing the reduction in the size of the gland following treatment are we believe, unique.

**Case.** Zoe G. age 30 weeks sent in for admission to Maternity and Children Hospital December 7, 1913. On history obtainable noted that she was an 8-month-old child, has had colds and coughs since early life and attacks of wheezing and stridorous cough and dyspnea during the last month. Her voice is clear during sleep, the difficulty in breathing is less. When picked up or exposed to cold the difficulty is greater. She has difficulty in swallowing.

**Examination.** Weight 7½ lbs. The neck soft, no stridorous attack face blue respiration so marked inspiratory stridor with slight cough. Nose clear, ears and eardrums

normal. Auscultation rattling, wheezing, and crepitations, fine and coarse mucous rales over whole chest, front and back. Breathing resembles the noise of boiling tea. While listening breath sounds stop for few seconds, then air is heard to enter. There is sinking in of suprasternal and substernal region on inspiration and simultaneous bulging of anterior fontanelle. Percussion over chest, normal. Heart clear, no abnormality. Percussion over thymus shows right border two centimeters right of sternal border at level of second rib. Left border 1½ centimeters right of sternal border. Thymic dullness below navel and third of heart. These findings confirmed later by roentgenogram by M. Dachtle (Plate 1). Other physical findings negative.

**Diagnosis.** Adenoid enlarged bronchial glands and other causes of laryngeal stenosis being excluded, diagnosis of thymic asthma is made.

On December 24, 1913 first treatment by exposure to X-ray after which she seemed more distressed and refused food but improvement in breathing noticed the next day December 26th. Second treatment. After effect not so noticeable but cough is feebler. December 27th. Third treatment. No longer continuously cyanosed breathing much easier. Suffocative attacks, which had occurred six to seven times in the early four hours, occurred only twice yesterday. Thus and preceding treatments given at distance of two inches through leather filter only—one Holzknecht unit each. December 28th. Fourth treatment one half Holzknecht unit. Almost no suffocative attacks (night) only two exposures to cold almost complete pharyngeal inflammation subsided.



Plate 1. Case 1. Thymus enlarged to the right.



Plate 2. Case 1. Six X-ray exposures. Absence of thymic hypertrophy.



fractures the amount of separation of the tibiofibular joint or the laceration of this ligament may give indication, but the surest means of detection is careful study of the dried skiagram.

Posterior displacement of the foot does not occur in the ordinary Pott's and where it does we must consider clinically that something more has happened in the ankle area than mere fracture of the fibula. If the fibula is broken three or four inches above its lower end if the internal lateral ligament is ruptured at the same time, or if the tip of the internal malleolus is pulled off we will not get a posterior displacement of the foot. If all the soft parts around both malleoli are severed if both lateral ligaments are cut there will be no posterior displacement of the foot.

If then we find such posterior foot displacement, what must we consider? When the astragalus is displaced backwards it can only occur when the external malleolus is freed fully from the external side of the lower end of the tibia. Should both malleoli be broken and the tibiofibular junction and ligament remain intact, no posterior displacement presents, although we might find all degrees of internal or external displacement. To obtain the freedom of the external malleolus then we must have either a fracture very low down on the external malleolus, which allow the lower fragment with its attached strong ligaments, by its obliquity to slip back or a distasis of the tibiofibular junction with laceration of its ligament or possibly a fracture of the fibula high up with its line extending down into the tibiotarsal joint. There seems to be little doubt that fracture of the posterior lip of the tibia of varying degree is due to a further action of the force of separation of the tibiofibular ligament which being stronger than the bony surface into which it is inserted pulls out the corner of the tibia and preserves its own fibers intact but allow the separation and displacement of the astragalus. To this I added, of course lesions of the two lateral ligaments or the malleoli. The foot in so being displaced posteriorly drag with it in practically every case the malleoli. Hence we conclude that fracture of the posterior tibial lip alone is not sufficient to allow posterior

displacement of the foot, even when accompanied by malleolar damage unless the external malleolus is freed as mentioned.

Treatment for all ankle fractures should be prompt reduction under anesthesia the possible exceptions being those cases greatly traumatized and swollen beyond manipulation. If slipping fragments or sharply pointed malleolar fragments threaten to necrotize through the skin they should be reduced at once. Where manipulation fails, I believe subcutaneous extra-articular nailing is the proper step. Old fractures may be reduced after three or four weeks by manipulation or by open operation consisting of osteotomy of the fibula, operation for removal or replacement of marginal pieces perhaps by nailing them on or in severe cases, operation on the articular surface of the tibia accompanied by fibular osteotomy and a clearing out of the callus in the tibiofibular ligamentous area. Other cases may be best handled by a leveling operation on the head of the astragalus with replacement in the weight-bearing axis or a complete astragalectomy.

#### SUMMARY

1 Ankle fractures are relatively numerous and have much influence on the wage-earning power of laboring people.

2 Pott's fracture as classically understood is very rare.

3 Each ankle fracture should be treated in accordance with the most searching diagnosis, aided if possible by skiagrams and not by routine method.

4 Too much faith should not be given to anteroposterior skiagrams through the ankle mortise. Lateral view should be made to show the correct position of the astragalus in the anteroposterior axis and to reveal slipping fractures.

5 More emphasis should be laid on the treatment of fracture of the external malleolus with or without ligamentous damage on the inner side of the ankle by overcorrection in extreme inversion on a splint or in a cast.

6 Special attention should be paid to cases with posterior or anterior displacement of the foot as these indicate slipping fractures of the tibia or complete separation of the external



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## ELECTROTHERMIC COAGULATION AND RÖNTGEN THERAPY IN THE TREATMENT OF MALIGNANT DISEASE

RICHARD PFAHLER, M.D., PH.D.

SINCE I have devoted most of my professional life to the study of roentgenology and am now to address you who have devoted most of your time to the study of electrotherapeutics and its allied branches, it is fitting that I should choose as my subject one which will show the effect of combining these two great fields of medical effort in the treatment of malignant disease.

The method consists in the complete destruction, or the removal of all visible and palpable malignant disease by means of the diathermy current, followed or at times preceded by full doses of the roentgen rays, given from as many different fields of entrance as is possible so that as much irradiation is produced as though the rays alone were depended upon for the cure of the disease. In this way one is attacking the disease by the two most powerful forces known for the treatment of malignant disease either of which alone is often sufficient to cure malignant disease.

To Nagelschmidt and Dryen belong the credit of introducing first the use of the high frequency currents for the coagulation of tumor tissue between the two poles of the diathermy current under the terms *thermopenetration* or *electrocoagulation*. The credit of developing roentgen therapy to a high degree of efficiency belongs to many men each of whom has contributed some factor of importance. I believe however that by skillfully combining the two may be able to prevent many failures that are encountered by either method alone thus almost doubling our total results.

## TECHNIQUE

The technique of the electrotHERMIC coagulation is somewhat similar to that described by Nagelschmidt and in principle is identical. The *diathermy current* is used and *instrument* is necessary which will generate from 500 to 1,000 Ma. of current. The amount of current will, of course vary with the amount of destruction of tissue necessary.

Two electrodes are used, attached to the two poles. We, of course know that the diathermy current is alternating in character. The shape and character of the electrode will vary with the character of work required. For instance if one desires to remove a portion of a lip

I would use on the inside a ball electrode about three eighths of an inch in diameter and on the outside, a needle point electrode. Then I would outline the area of the diseased tissue to be removed, by allowing the current to flow from this point toward the ball electrode on the inside and I would then coagulate the entire diseased tissue. At first I depended upon the needle electrode actually to carve out the diseased tissue, but now I find it simpler to cut this away with a pair of curved scissors, after coagulation, always cutting within the coagulated tissue. In this way there is no bleeding and the edges are completely sealed off. The blood vessel and lymphatics are at no time opened which I believe to be a distinct advantage in the prevention of metastases and ultimate cure of the patient.

In destroying an extensive lesion in the cheek, I use a flat electrode one inch in diameter on the inside and a point electrode on the outside. In destroying a portion of the tongue I have used two point electrodes. The electrodes are held in contact with the tissue.

One must always be as sure as is possible to destroy the entire diseased area, for there is danger of apical extension from the periphery if all the disease is not destroyed—unless it is possible to control this tendency by the deep roentgen therapy. The tendency to the increased rate of growth of areas not removed by this process, or by operation, is probably due to the increased congestion which is brought about by the subsequent reaction.

*Anesthetic.* In this extensive destruction the pain is intense and some form of general anesthetic is always necessary. For this, one may use ether or any of the general anesthetics. For mouth cases, however in which I have had most experience, I find that ether causes so much mucus and congestion about the mouth that the difficulties are increased. First, because the disease generally limits the degree to which the mouth can be opened and the visible field is further decreased by the congestion in filling the tongue and mucous membrane. Second, the mucus carries away or distributes the current somewhat, and thus the area of destruction is less sharply defined. Then too, one must always consider the possibility of ignition of the ether



Fig. 3. Epithelioma of mouth. T. of carcinoma.  
Fig. 4. Mouth.

Fig. 5. After electrothermic coagulation and biopsy.  
Fig. 6. After operation for closing the mouth.

and an explosion. Therefore in most cases, I use a hypodermic injection of one or one and a half tablets, each of which contains hyoscine hydrobromide gr. 1.00, morphine hydrobromide gr. 1.4, and atropine gr. 64. So far this has given no untoward symptoms, but very satisfactory results. In those cases in which there has been an habitual use of alcohol, this is likely to be insufficient, and in such instances I have had to add ether.

#### DEEP RONTGEN THERAPY

**Object.** The object of the rontgen therapy is to control or destroy the outlying cells or metastases that may be missed in the coagulation process. Therefore the treatment must be thorough and given with the understanding that disease may still be present for if one is sure of having destroyed all of the malignant disease there is no object in adding the rontgen therapy. This treatment must always be given with the technique used for deep disease for one should never treat any superficial or shallow disease behind.

**Time of treatment.** I commonly precede the tissue-destruction by a series of treatment or doses given through as many areas as is possible

covering the entire parasympatric and glandular areas which are likely to be involved by metastases. In two weeks, after the destruction of the disease this series of treatments is repeated and again subsequently at intervals of three weeks or longer as often as seems necessary from the nature and the extent of the disease. When rontgen therapy does not precede the electrothermic coagulation, one should follow it with these treatments just as soon as the patient can be moved to the laboratory which is usually within a day or two.

The skin dose must be carefully measured, so as to give all that the skin will tolerate without doing damage. This is the erythema dose and when measured by the Kaenboch quantummeter it equals 10 % of unfiltered rays measured by the Soboraud and Azert pastilles, the erythema dose is recognized by tint. If measured by the Hotalnrecht radiometer the dose equals 10 unit. When the rays are filtered through three millimeters of aluminum and one-eighth of an inch of sole leather, under the aluminum, and then the rays are given from a tube producing uniform, high penetrating gamma rays, the dose can be increased to 25 measured under the filter. Thus also multiply the deep effect by three.

The area and the number of areas through

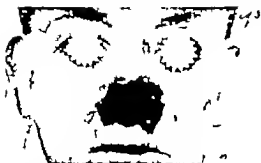


Fig. 5 Epithelioma of nose nine years and after unsuccessful treatment with plaster



Fig. 6 After electrothermic coagulation and roentgen therapy

which each dose is given will vary with the extent and depth of the disease, the amount of or tendency to glandular metastasis, and the degree of malignancy. The size of each area will depend upon the number of points of entrance required and the extent and depth of the disease. The deep effect is multiplied by the number of points of entrance. For instance, if the surface of the skin is divided into twenty-five areas and there is given through each area a full dose directed toward the center of the disease, this center gets twenty-five times as much ray as if the whole area of skin were covered at once. It is self-evident that it requires twenty-five times as long to treat the patient through these twenty-five points, as if the whole area of skin were treated at once. Therefore the expense is also increased. Much of the end-result will depend upon the judgment of the roentgenologist in planning the treatment, as well as upon his skill in executing the treatment.

The amount of treatment that can be given through any specified area of skin is spoken of as a *dose*. The number of doses required to be given in order to cover the entire field is spoken of as a *series of doses or treatments*. The interval between any two series of treatments or doses should never be less than two weeks, and generally it is safer to allow three weeks. The length of this interval will vary with the degree of malignancy. When one is fighting a severe and advanced case of malignancy I believe that one is justified in taking some risk of a dermatitis, rather than give too little and allow the disease to progress. The number of series of treatments required will vary with the individual case. Generally I repeat every two or three weeks for three or more series. Then, if all seems well, the interval is rapidly increased.

The quality of rays used is measured chiefly in degree of penetrative power according to one

of the scales. For example, measured by the Benoit penetrometer it should register 7 to 8. A tube should be used which will give out this quality of rays continuously. The Coolidge tube will do this when carefully controlled. The time required to give a dose will depend upon the amount of current that can be passed uniformly through the tube without causing a variation in the vacuum. Filters must always be used in this character of roentgen therapy. At present, I use three millimeters of aluminum and under the aluminum one layer of sole leather. This filtration allows one to increase the value of deep radiation several times.

*Cases suitable for this combined form of treatment* (1) Those cases in which there is a considerable area of malignant tissue which can be removed *en masse* and which is too great to be destroyed completely by the electrical desiccation described by Clarke. For small superficial epitheliomata, warts, moles, and birthmarks, I much prefer the desiccation method.

(2) Epitheliomata involving the deeper portions of the lip, cheek, tongue, or alveolar process, especially those which have been treated for a considerable time with the roentgen rays, without success. Epitheliomata on other parts of the body which are large and especially if they must be allowed to heal by granulation.

(3) Old adherent scirrhous carcinomata of the breast in which there is no evidence of metastasis, and which are considered inoperable by surgical means.

#### DISADVANTAGES OF THE TREATMENT

1. There is complete destruction of all the tissue between the two electrodes. Therefore, there is no chance of saving the blood-vessels or nerves which are in close proximity to the disease.

It leaves an open area, which is healed by granulation but at times this healing must be



Fig. 7 Epithelioma of lip one year before electrothermic coagulation.



Fig. 8 Healed after electrothermic coagulation and deep cautery therapy.

followed by a surgical plastic operation to close the mouth or to correct some deformity.

#### ADJUSTINGS

1. There is complete destruction of the local malignant disease.

2. Thus accomplished without opening the blood vessel or the lymphatics, and I believe that this method of treatment is less likely to be followed by a recurrence or metastasis.

3. The wound heal with a smooth, soft scar which resembles skin very closely.

4. At times one is enabled to apply this combined treatment in surgically inoperable cases.

Case M. J. L. P. age 41 (top 34). Referred by Dr. H. W. Duckler of Toledo Ohio January 30 '35. An epithelioma had been growing on the angle of his left cheek for 4 years. This had been treated in small bits by the roentgen ray for nearly ten years. Under active treatment by Dr. Duckler a nearly drop period. The treatment was interrupted. A recurrence then developed which could not reach the surface. When he came to me, the disease involved half of the upper and half of the lower lip. It extended inside the cheek to the angle of the jaw and on the outside of the cheek there was cauliflower growth about one inch and a half in diameter. The patient was given injections of hyaline morphine and caustic and all of the diseased area excised by electrothermic coagulation back to the edge of the jaw and then by means of the Garlin current the disease back extended beyond the angle of the jaw until the mucous membrane was destroyed. The deep portions of the mucous membrane he angle of the jaw there as tendency recurrence for thirteen months. This was destroyed repeatedly and each was followed by series of doses of radium (2). I all be received fifty doses of radium and 3 milligrams of radium treatment. February 9 a all evidence of malignant disease had disappeared and Dr. Ernest Laplace did plastic operation for the closure of his mouth with excellent result.

Case Mrs. M. L. age 60 (Fig. 3) referred by Dr. John A. Bauer of Chicago. For nine years she had an epithelioma growing from the nose. I grew especially rapidly within the last year after unsuccessful treatment with plaster. The disease in 4 of the lower

half of the nose including the mucous membrane as well as the skin (see photos).

The diseased area was removed by electrothermic excision and after treated by roentgen therapy — cut down. The first treatment was on May 7 to 9. An excellent result was obtained and she has remained off C. 103 M. A. P. U. since 63 referred by Drs. Neal Martin, Gleason, and Warnock (each separately) as an inoperable and hopeless case. The case to see March 7 '35 having suffered from sores in the region of the lower and floor of the mouth for only ten weeks. He noticed sores in replacement for artificial teeth. It likely that the irritation of this place was the cause of the epithelioma. I found malignant disease involved the anterior half of the lower lip, the right lower alveolar border and the floor of the mouth extending 1 inch and one half back.

The disease was completely destroyed by electrothermic coagulation in the first two weeks. Large pad electrodes in turn on the hot cut and point electrode as the mouth. This was followed by deep roentgen therapy. On April 1 all parts received 100 mm. of the roentgen as deep tissue. A portion of the alveolar ridge had been lost. At my request this was removed. Dr. Warnock and the patient as was known.

April 20th he returned practically free from all evidence of disease. Drs. Gleason and Warnock examined him and could find no evidence of disease. He remained apparently off six months until Oct. 1935. A small ulcer one fourth inch in diameter developed. At first I was uncertain as to whether this was an ulcer due to my nitrogen and radium therapy or due to the disease. It did not seem to be an ulcerated base and margin hard to be made of the jaw. This should have been thoroughly destroyed at once but I hesitated until there was no certainty of the diagnosis of malignancy after which I was unable to control the disease by any means. It did recede.

In this case, what promised to be a brilliant success proved a failure because of my timidity. Consultation did not help me in my early diagnosis of the recurrent case.

Case M. J. age 5. Referred June 1, 1935 by Dr. W. H. Lee. An epithelioma had been on the nose for 10 months and at his end but the growth involved almost one fourth of the nose. The alveolar border was on the left alveolar border. The disease of the mucous membrane. The electrothermic





Fig. 1. Epithelioma eight years' failure under all forms of treatment.

al outer border of the upper jaw. It had been growing three months, as two inches long, one inch wide and three fourths of an inch thick. It dropped under the plat of artificial teeth and in probably due to this irritation.

As given an injection of hyaline morphine and curium, and the entire diseased area destroyed by electrothermic coagulation. At this time it was found that the disease involved the entire depth of the alveolar process and extended into the maxilla. She was given active deep roentgen therapy and radium treatment of wounds on outside the mouth.

There has been no recurrence since. It has been destroyed. I shall fail on this as ultimately but even this failure she has been made more comfortable than she would be, being able to eat and speak and grow in filling the mouth.

CASE. Mr. R. H. age 44, as referred by Dr. Thomas Byrne, Decatur, Ga., with an epithelioma of the bone of the mouth which had been growing at least three months. The disease included the under surface of the tongue, the bone of the mouth, the alveolar border and inner wall of the lower jaw from the buccal region on one side to the buccal region on the other. Metastatic nodules could be felt in the subcutaneous region on both sides. The Stillwell Burns act and against any surgical interference.

Under an injection of hyaline morphine and curium the anesthetic disease was destroyed, the teeth removed and the alveolar process and inner wall of the bone was destroyed. Then with bone forceps the dead bone was chipped off, curetted and the surface again treated with heat. (Oudin spark).

This operation was followed by active ongoing therapy made out. All parts healed nicely and all but one enlarged gland disappeared. Three months the surface of the bone which had been devitalized was thrown off as a sequestrum. Strange to say the mucous membrane had healed under the sequestrum and the bone seemed healthy. At this stage it looked as if he would certainly get well. However, the one metastatic gland would not disappear and now at the end of 4 months this gland has grown and is involving the floor of the mouth. There has been no other enlarged glands.

The noteworthy features of this case are—  
(1) That an absolute hopeless case (by any other means of treatment) rendered comfortable for



Fig. 2. Well after electrothermic coagulation reaction of dead bone and plastic operation. The small bit area to the left of the flap is small mass of dead bone which had not been removed.

44 months, and free from symptoms for three months. (2) That carcinoma of the bone was locally destroyed with recovery of the remaining bone. (3) That the devitalized bone was thrown off bodily with the healing of the mucous membrane over the surface of the healthy bone. (4) That all but one of the metastatic glands disappeared. (5) That the patient has been able to attend to his regular business except during the first three weeks.

CASE. Mr. B. M. D. age 35, as referred by Dr. John A. M. Koon, April 9, 1915, on account of an epithelioma of the bone of the mouth which had been growing in the bony portion of the scalp in the right temporal region.

This was destroyed by electrothermic coagulation local and followed by full dose of Strahl rays over the entire area. The patient has not been able to return for further treatment but the wound is nearly healed. (April 6, 1915).

CASE. Mrs. K. I. age 68 (April 11) referred to me by Dr. W. L. Rodman, April 3, 1915. Large scirrhus carcinoma of the right breast. It had been growing 18 years. Had been treated by plaster (Fig. 3). This was removed, the chest 49 and as considered entirely inoperable by Dr. Rodman. We could detect no glandular enlargement in the axilla or supraclavicular region. A roentgenogram of the chest showed the shadow of the tumor and in addition a number of small dense glands along the mediastinum. On account of the absence of palpable glandular involvement as well as the possibility of mediastinal glands not being palpable I considered my combined treatment applicable. It is in breast so that I considered this method. I am most favorable.

Therefore I treated the tumor by electrothermic coagulation and from the surface downward then soaked malignant was well reached. The axilla was treated by active ongoing therapy. I had 1000 r in the axilla and 1000 r in the breast. I penetrated the breast and 1000 r. This was followed by full dose of Strahl rays therapy and to June 7. I can detect no evidence of malignancy and he seems to be well. The breast is still very red. The patient is



Fig. 3. Adherent scirrhous carcinoma of the breast. Growing for years. Had been unsuccessfully treated by plaster.



Fig. 4. Healing by healthy granulation. See the smooth soft skin. June 9, 4.

free from symptoms, and has regained general health and strength. When examined by D. Rodman and myself Oct. 1, no evidence of malignancy could be found and the wound is almost healed.

The points of great interest in this case are—  
(1) That it was a scirrhous which had been aggravated by plaster treatment applied by a charlatan.  
(2) That it was inoperable. (3) That it was not suitable for roentgen therapy alone. (4) That it was completely and successfully destroyed by electrothermic coagulation and roentgen therapy.

CASE 3. M. C. H. H., age 52, referred by Dr. F. J. Barnard, April 20, 1914, with an epithelioma involving the right cheek, the angle of the jaw on the inside, the entire right lower alveolar border, and the floor of the mouth. There is one palpable gland.

The tumor recurred inside and outside by roentgen therapy, the eighth full dose. The disease as destroyed by electrothermic coagulation 1 month later. As was evident of recurrence. The tumor was thoroughly destroyed by electrothermic coagulation. He then improved in his general health and looked off but when examined Sept. 10, 1914, recurrence of about one-fourth of the extent of the original disease was found and this destroyed. I believe he has a reasonable chance of recovery.

CASE 4. M. J. C., age 5, as referred by Dr. W. H. Rodman, March 8, 1914, on account of large recurrent epithelioma on the back of the upper lip. He was born with it four years ago. The tumor began to develop one month previously. The tumor was removed surgically. It recurred and was again removed in three weeks. A time of beginning roentgen therapy here, as some patients with the edges. Under treatment he has had practically complete relief. He then stopped coming. He developed a small tumor on the lower lip, which was completely destroyed by electrothermic coagulation after which he was given four full doses of roentgen rays, each one repeated at the end of 1 month. At the end of 6 months

there is no evidence of malignant disease. Since then he has not returned for examination and treatment.

CASE 5. Mrs. A. S., age 45, referred by Dr. J. Root, 1 place March 9, 1914, had malignancy of growth took the tumor eight months. The tumor previously it had been used. It promptly recurred. Former tumor 1 inches long and one-fourth inch thick, lying between the tongue and the alveolar process. A section examined by Dr. Eugene Caw showed it to be an endothelioma. It was totally destroyed by electrothermic coagulation. This was followed by 10 full doses of roentgen rays. She grew careless about the treatment and returned November 9, 1914, with recurrence. She was given 10 full doses of roentgen rays with complete disappearance of the disease and he has remained free now 6 months.

This case is of especial interest because—

- (1) It was considered inoperable by the surgeon.
- (2) It was a recurrent endothelioma.
- (3) It was destroyed but, through carelessness of the patient, recurred.
- (4) The recurrence disappeared under mass doses of deep roentgen therapy.

CASE 6. M. J. L., age 45, referred by Dr. H. A. Cline et al., 9, 11, had an epithelioma growing upon his lower lip 7 years. He was an alcoholic and a smoker. For 7 years he was treated by the roentgen rays in another city. At the end of this time, the radiation was of red about one-third of the lower lip. There is evidence of repair and keratinization present. In such cases I have found that further roentgen treatment is useless. I therefore removed about one-third of the lower lip by electrothermic coagulation, and followed this by deep roentgen therapy locally and over the submaxillary region. There is no present evidence of malignant disease. A plastic operation is now necessary to close the wound on his lip.

The points of special interest are—  
(1) That the patient had smoked epithelioma for two years.  
(2) That it was treated unsuccessfully for a year with the roentgen ray by small fractional doses.  
(3) That the destruction was brought about by electrothermic coagulation because I

believe in such cases this procedure is less likelihood of a recurrence or metastasis than surgical excision. (4) That the patient is free from any evidence of malignant disease September 2, 1914 and I believe he will remain well.

CASE 7. M. G. H. age 64 referred by Dr. Robert Abbe and Frederick C. Halsey, June 9, 1914. January 9, 1914 polypus was removed from the right nostril which was found to be malignant. He then treated with radium 5 days then referred to Dr. Abbe who did an extensive operation removing the right alveolar border and encircling the nostril and right half of the nostril. This was followed by radium treatment. A extension of the growth developed about month, in alveolar bone and half inch of the alveolar and left nasal region. This disease I destroyed by electrothermic coagulation, June 9, 1914 and preceded and followed the destruction of the disease with radium doses of deep roentgen therapy. The first series he received 800 X without producing any harm. This was also treatment as given on one day. No harm and no malignant disease evident June 20, 1914. Some epithelial disease on posterior wall of nostril September 2, 1914.

The points of interest here are — (1) A small operation followed by an extensive operation. (2) Radium application for a month had no apparent effect. (3) Extensive operation followed by massive dose of radium, and again a recurrence. (4) Electrothermic coagulation of the active disease and with massive doses of deep roentgen therapy as would hardly be justified in a less desperate case.

CASE 8. Mrs. M. L. age 51 referred by Dr. J. J. Zuker, June 24, 1914 with new growth of the gums between the right lateral incisor and the cuspid tooth of the lower jaw. This growth had been developing for two and had caused some separation of the teeth. Also presence of disease in the upper portion of the alveolar process above by roentgenograms. The three adjacent teeth were removed.

The whole area was destroyed by electrothermic coagulation and then portion of the bony process covered with bone foreign. Later this destroyed. I could proceed through all similar to Case 7.

CASE 9. M. I. age 60 referred by Dr. S. W. June 5, 1914 with an extensive deeply ulcerated carcinoma extending from the left lower can bone. It was one inch wide and one half inch thick. It had been growing three years and had been some- what

fully treated by cancer paste applied by Charles. There was an adherent subcutaneous phlegm one inch in diameter not sharp outlined much the left side of the jaw. Dr. Still of Boston at my request removed the gland, and cauterized the malignant ulcer but he could not remove all of the disease. About the inner canthus and neck the bone had about a noon deformity. Therefore I added thermic coagulation and followed this active deep roentgen therapy applied locally and over the phlegm of the neck.

This case is of interest because of (1) the three years duration. (2) the harmful treatment by cancer paste. (3) the metastases and extension incompletely removed by surgery. (4) further destruction and treatment with deep roentgen therapy.

CASE 10. M. M. age 41, died October 7, 1914 by Dr. George W. Phipps and Dr. M. P. W. mouth with an epithelioma on the right side of the soft palate the alveolar process about the cuspid tooth, and the cheek. The hole was completely destroyed followed by roentgen therapy. On December 6, 1914 the alveolar teeth were removed and the disease about the alveolar process again destroyed. January 4, 1915 he is still perfectly well. Dr. Warrington considered this case entirely inoperable.

## CONCLUSIONS

1. Electrothermic coagulation permits the destruction of a number of inoperable carcinomas and epitheliomas.
2. It is a bloodless operation and gives decided advantages in malignant disease about the mouth.
3. I believe that this stage is less likely to follow because the operative area is at once completely sealed.
4. The disease must be destroyed completely.
5. Deep roentgen therapy must be applied with the best technique and with the same degree of thoroughness as if it had not been previously destroyed.
6. Good results have been obtained in a number of otherwise hopeless cases.
7. The time is still too short to express any valuable opinion as to its permanency.

## TRAUMATIC DIVERTICULUM OF CÆCUM FOLLOWING APPENDECTOMY

B. FRANK E. BUNTS, M. D., CLEVELAND, OHIO

SO far as I am aware attention has not yet been called to this interesting condition sometimes following appendectomy but I feel sure that it is only necessary to mention it in order to have its presence corroborated many times.

The first case in which I noticed it was a nurse who had been operated several years previously for a non-suppurating appendicitis. Following the operation the pain of which she previously

examined the site of the previous appendiceal operation and found a distinct white ring where the purse-string suture had been placed, but spread out to nearly three fourths inch in diameter. From this ring there protruded a pouch like the finger of a glove though somewhat conical and nearly one inch in length. By squeezing the cæcum I could force this to balloon up with gas. Its wall was quite thin, apparently devoid of any mucosa, and could be invaginated easily back into



Traumatic diverticulum of cæcum following appendectomy.

complained, entirely disappeared for nearly a year when she began to have renewed attack of pain in the right side. Examinations were made on various occasions by other physicians as well as myself and it seemed that the pain must be due to a slightly enlarged ovary in the right side. Her suffering was so great that he begged for an operation at each attack but the local conditions hardly seemed to me to justify an operation for the removal of the right ovary. However after witnessing her suffering in three of these attacks, I opened the abdomen through the right rectus muscle and found the right ovary slightly enlarged and cystic. As a matter of curiosity I

examined the site of the previous appendiceal operation and found a distinct white ring where the purse-string suture had been placed, but spread out to nearly three fourths inch in diameter. From this ring there protruded a pouch like the finger of a glove though somewhat conical and nearly one inch in length. By squeezing the cæcum I could force this to balloon up with gas. Its wall was quite thin, apparently devoid of any mucosa, and could be invaginated easily back into

the cecum. Feeling that the distention of this diverticulum might be the cause of some of her colicky pain and that its extreme thinness might make it a positive source of danger from rupture it was pushed back into the cæcum and a double row of purse-string sutures applied to close the opening.

Subsequent to the operation the pain had disappeared but it is evidently impossible to say whether this diverticulum was in any way to blame for the pain yet it seems rational to believe that it was to some extent, at least.

Since this time I have examined the cæcum in all pelvic operations in which the appendix had

previously been removed and have found two more distinct cases, though not nearly so large as the first, but the widened ring and thin dilatable wall were plainly to be seen, and in all I followed the procedure used in the first case. How much this diverticulum—or hernia, as I was first inclined to call it—of the caecum had to do with the patient's symptoms I could not say in any of the

three cases, all had pain in the right side and all had ovaries that might readily be considered sufficiently abnormal to have caused the disturbance.

It is possible how or that future observations may establish this condition as a definite cause of recurring pain in the right side following appendicitomies.

CAUSTOMOSIS OF VAS DIFFERENS TO EPIDIDYMS OF OPPOSITE  
SIDE FOR STERILITY'

R. FRANKS R. HAGNER M. D. R. SMITH D. C.

Professor of Plastic Surgery, Stryker Foundation (an early foundation for the Stryker Corporation), University of Michigan and Director, Stryker Foundation, Stryker, Michigan.

THE following case of tritity following double epididymitis presented a phase that allowed us to do an operation which so far as I know has not been performed heretofore.

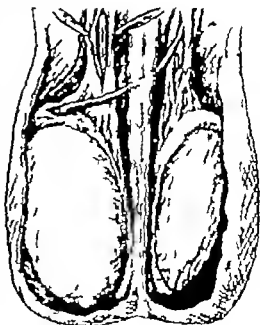
J. J. and his wife had age so prevented himself with diagnosis of vesical following prostatic glandular carcinoma. Five years ago he constructed his prostatectomy which is complicated by double cystitis. He has been married 8 years and his wife has been pregnant. Repeated examinations has shown no spermatozoa. He is operated on first in the fall of 9 and bilateral castration by removal of the deferens and the globes major and minor. With time no spermatozoa could be obtained from the left globe major and from section through the same substance showed no spermatozoa this tissue being softened and atrophied. The 22 deferens as previously indicated by small probe. The right side was then operated on and normal appearing tissue as found on left. Thickening of the globes major. When a section as made into the globe major for examination no spermatozoa are obtained. There are some atrophic cells in this section differed from those found in case of vesical cancer. On examination he has deferens on his side the first testis probe could be proved through it human although it was as large as practicable in the lower testis tubules.

[illegible]

From our experience this was certainly an unfavorable time because of the fever of the mosquitoes and their lack of motility. The

operation so far as benefiting the patient was concerned, was a failure he was a sterile as ever as was proved by repeated examinations of the fluid collected in a condom.

Although this particular case was unsuccessful, there is no logical reason why either male bird presenting the same features except for the presence of motile spermatozoa should not be successful.



Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8	Ex. 9	Ex. 10	Ex. 11	Ex. 12	Ex. 13	Ex. 14	Ex. 15	Ex. 16	Ex. 17	Ex. 18	Ex. 19	Ex. 20	Ex. 21	Ex. 22	Ex. 23	Ex. 24	Ex. 25	Ex. 26	Ex. 27	Ex. 28	Ex. 29	Ex. 30	Ex. 31	Ex. 32	Ex. 33	Ex. 34	Ex. 35	Ex. 36	Ex. 37	Ex. 38	Ex. 39	Ex. 40	Ex. 41	Ex. 42	Ex. 43	Ex. 44	Ex. 45	Ex. 46	Ex. 47	Ex. 48	Ex. 49	Ex. 50	Ex. 51	Ex. 52	Ex. 53	Ex. 54	Ex. 55	Ex. 56	Ex. 57	Ex. 58	Ex. 59	Ex. 60	Ex. 61	Ex. 62	Ex. 63	Ex. 64	Ex. 65	Ex. 66	Ex. 67	Ex. 68	Ex. 69	Ex. 70	Ex. 71	Ex. 72	Ex. 73	Ex. 74	Ex. 75	Ex. 76	Ex. 77	Ex. 78	Ex. 79	Ex. 80	Ex. 81	Ex. 82	Ex. 83	Ex. 84	Ex. 85	Ex. 86	Ex. 87	Ex. 88	Ex. 89	Ex. 90	Ex. 91	Ex. 92	Ex. 93	Ex. 94	Ex. 95	Ex. 96	Ex. 97	Ex. 98	Ex. 99	Ex. 100
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

## AN AID TO THE LITTLE-DÖDERLEIN METHOD FOR OBTAINING LOCHIAL CULTURE

B. WILLIAM FAWCETT SHAW M. D. NEW YORK

THERE is no obstetrician who has escaped the responsibility and care of puerperal sepsis in one or more of its forms. It is the consensus of current opinion that the cause of infection should be sought for in a culture obtained from the interior of the uterus.

Anyone who has studied this question has been struck with the fact that no matter how much care is taken there is still a possibility that contamination has ensued.

H. M. Little's modification of Döderlein's method for obtaining such culture is usually employed. This consists in the use of a glass tube 35 cm. in length and 3 or 4 mm. in diameter through which is threaded a piece of strong silk, to one end of which a rubber band is attached. After sterilization this lochial tube is introduced under aseptic technique into the uterus and on making traction upon the thread a certain amount of infected lochia is drawn up into the tube by suction.

We believe we have added to the excellence of this method by the employment of an old-fashioned terine packer as a container for the lochial tube. By so doing we insure against contamination in the introduction of the tube and at the same time avoid the use of a bellum forceps, the bit of which upon soft spongy and often lacerated cervix is detrimental to the best interests of our patient.

A considerable experience has justified our belief that we have been uniformly successful in obtaining uncontaminated cultures.

The rough sketches herein show illustrate our modification which we have reason to think results in more satisfactory bacteriological report.

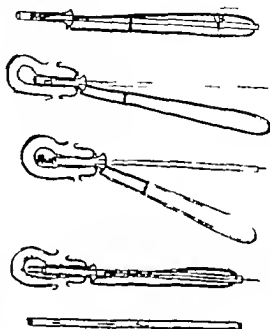


Fig. 1. Uterine packer ready for sterilization. End of glass tube and rubber bow protected from contamination by its cervical speculum. Rubber band at X holds glass tube and handle.

Fig. 2. Cervical speculum in place, end of tube and rubber bow still protected.

Fig. 3. Glass tube pushed through speculum and forced as here rubber bow comes in contact with infected lochia.

Fig. 4. Rubber bow containing lochia drawn back into sterile glass tube about its middle.

Fig. 5. Glass tube withdrawn and closed with seal, X, and ready for laboratory.

malleolus with loss of support of either anterior or posterior tibiofibular ligaments. Operation should be considered in these cases, particularly to obtain the best result.

7. Operative measures, of simple replacement, nailing, or other procedures give perfect anatomical results in selected cases.

8. Use of the foot should not be permitted until pain is not caused.

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## PLACENTA PRÆVIA AND ITS TREATMENT<sup>1</sup>

By FREDERICK DOCTOR W. NAGEL, BERLIN, GERMANY  
*Honorary Fellow of the American Gynaecological Society and the Obstetrical Society in Edinburgh*

IT once seemed that with the introduction of version by the Braxton Hicks method the last word had been said in the treatment of placenta prævia. With this method the Berlin school, as represented by GUSSEOW and SCHROEDER achieved such remarkably favorable results as compared with the older method—viz. tamponade of the vagina until complete dilatation of the os, then version and extraction, or in cases of impaction of the foetal head, forceps—that it soon became the dominating one in Germany. Hofmeier<sup>2</sup> in Schroeder's Clinic had but one maternal death out of 37 cases, Behm<sup>3</sup> in Gusseow's Clinic had 35 cases and no death. Later Zweifel published 63 Wegelin 16 and Hauck 18 cases, all three also without any maternal mortality. Doderlein gives the average maternal mortality at 7.8 per cent, and the infant mortality at 73.7 per cent. This latter figure is unfavorable as compared with the average infant mortality of 54.19 per cent under the older method.

It is unjust to attribute the high infant mortality to the treatment used as in most cases of placenta prævia we have to deal with immature children whose vitality has been

lowered by disturbances of the foetal circulation during labor as a result of the unavoidable abscission of the placenta. Even though these facts were apparent, the high infant mortality gave rise to a number of methods, partly based on the older methods, partly innovations. These methods I shall briefly describe.

1. *Abdominal cesarean section.* With an early diagnosis, good aseptic conditions, and a living child, the result must be a favorable one, and published reports show this to be so.

In the above mentioned paper by Doderlein, we find a large number of cases. Kronig (35) Sellheim (8) Parker Davis (7) Reussens (4) with no maternal mortality and an infant mortality of 0 (Sellheim) to 43.86 per cent. The average amounted to 8.9 per cent maternal and 33 per cent infant mortality. Cesarean section will, however, never be practicable in routine cases and Doderlein has even curtailed its use in hospital and clinical practice and gives as contraindications: (1) infection from the patient herself (2) fever (3) examinations made by physicians and midwives before admission to the hospital, (4) tamponade, (5) extensive hemorrhages, (6) marginal insertion of placenta (because in this case the patient can be confined in a simple manner) (7) in cases where foetus is

<sup>1</sup> M. Hahnemann Klinik f. Geburtsh. Gynäkol.,

Berlin, Klinik f. Geburtsh. u. Gynäkol. in

Edinburgh, Internat. Med. Cong., Lond., 1913.

<sup>2</sup> An extract of this paper was read in the discussion on placenta prævia in Section 1, 2 of the Seventeenth International Congress of Medicine, London, 1913.



Fig. 1 (top) Drawing showing the closure of the abdomen.  
Fig. 1 (bottom) Drawing showing additional split in external oblique close to sinus.

superior spine. By this method of procedure, in addition to the advantage of having one wall of the sinus made up by the lateral body wall of the abdomen, there is the added advantage that the pus-bearing sinus is removed from the original incision in the external oblique, fatty layer and

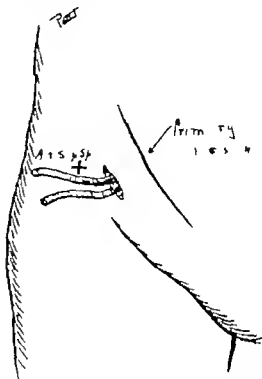


Fig. 3 Drawing showing tubes emerging in a short cut through skin.

skin. In the event that this wound is closed by reinforcement silkworm gut sutures tied over a pad of strongly antiseptic gauze in addition to an accurate layer suture, the original wound will be given the most favorable chance for primary union. Fatty layer infection will frequently drain beneath the skin through the drainage opening close to the anterior superior spine and thereby interfere to a minimum degree with the healing of the primary incision.

previously been removed and have found two more distinct cases though not nearly so large as the first, but the widened ring and thin dilatable wall were plainly to be seen, and in all I followed the procedure used in the first case. How much this diverticulum—or hernia, as I was first inclined to call it—of the caecum had to do with the patient's symptoms I could not say in any of the

three cases, as all had pain in the right side and all had ovaries that might readily be considered sufficiently abnormal to have caused the disturbance.

It is possible however that future observations may establish this condition as a definite cause of recurring pain in the right side following appendectomies.

## ANASTOMOSIS OF VAS DEFERENS TO EPIDIDYMIS OF OPPOSITE SIDE FOR STERILITY<sup>1</sup>

R. FRANCIS R. HAGNER, M. D., WASHINGTON, D. C.

Professor of Genito-Urinary Surgery, George Washington University, Attending Genito-Urinary Surgeon, Charles Memorial Hospital and George Washington University Hospital.

**T**HE following case of sterility following double epididymitis presented a phase that allowed us to do an operation which, so far as I know, has not been performed heretofore.

A male, late age, so presented himself, with diagnosis of sterility following gonorrheal epididymitis. Twenty years ago he contracted his gonorrhea, which was complicated by double epididymitis. He has been married 5 years and has never been pregnant. Repeated examinations have shown no spermatozoa. He was operated on first in the fall of 1901, and bilateral vasectomies between the vas deferens and the globus minor were done. At this time no spermatozoa could be obtained from the left globus major and even dissection through the vasca affligens showed no spermatozoa; the testicle being atrophied and atrophied. The vas deferens, parastroph, indicated by touch probe. The right side was then operated on and anastomosis appearing testis, as found except for thickening of the globus minor. When an incision was made into the globus minor for anastomosis, few spermatozoa were obtained. These are non-motile and in this feature differed from those found in our successful cases. On examining the vas deferens on the right the finger fear that probe could not be passed through it, hence although it went as high up as possible in the green testis parastroph.

The result of this operation was failure and I suggested to the patient the possibility of fusing the good vas on the left to the better organ, thus leaving the right testis. At the operation in the vas deferens of the left side was cut through and the distal end kept as an opening was then made in the septum to allow the sperm to pass through to the right side. Before the anastomosis was completed a small amount of spermatozoa was injected into the vas to be sure of its patency. The appearance of the vas deferens in the same as the first operation following his operation proved it patency. The anastomosis was then made. Although the condition present in the globus major of the right side at the first operation namely, only a few non-motile spermatozoa, was present also at the second operation. The patient made an uninterrupted recovery.

From our experience this was certainly an unfavorable case because of the fearfulness of the spermatozoa and their lack of motility. The

operation so far as benefiting the patient was concerned, was a failure, he was a sterile as ever as was proved by repeated examinations of the fluid collected in a condom.

Although this particular case was unsuccessful, there is no logical reason why other individuals presenting the same features except for the presence of motile spermatozoa should not be successful.

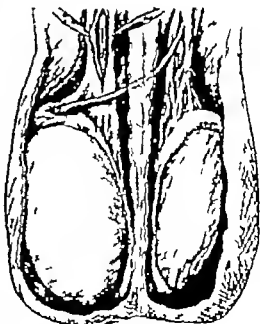


Fig.

In every case of operation its risks and results should be explained to the patient

I decide not to operate—

1. In any case of primary displacement

2. Where a patient is content to wear an apparatus for a considerable length of time

In operating on a knee-joint there is in my opinion, more risk of disaster than in almost any form of surgical procedure, and when disaster does occur it is overwhelming. The fact that over one thousand operations have been performed by so careful a surgeon as Mr. Robert Jones should not cause any one to relax his vigilance or to approach the matter except with the utmost care. I venture to say that the potentialities for mischief of one knee-joint are about equal to that of ten abdominal cavities.

A few points in technique may be mentioned. Very soon in my work I learned not to introduce any foreign material of any description into the joint. In one of the early cases the internal cartilage was sewn to the tibia with silk. The knee swelled, the temperature rose to 100° on the second day and I was obliged to let out some fluid. The patient recovered perfectly well, but the forty-eight hours of anxiety I underwent are not forgotten, and I have long appreciated the value of gentle manipulations within the knee-joint. It seems to me that the chief cause of infection may be, and probably not the in-

struments or the surgeon himself but the patient's skin. In knee-joint cases I am not yet satisfied merely with the acetone and iodine method of sterilizing the skin because the latter is often rough and thickened and I doubt if there is sufficient penetration. My practice is to have the whole limb washed with soap and water then with ether and alcohol, and wrapped in a compress of 1 in 3,000 bichloride of mercury. This is done on two separate occasions, 48 hours before the operation and then three hours before the operation the limb is carefully dried with sterilized swabs, acetone and iodine are applied, and the limb is wrapped in dry sterile gauze. Under no circumstances do I introduce a finger into the joint and the capsule is sewn with a blanket suture. In closing the skin, interrupted sutures of silkworm gut are used, the gut is threaded at either end through a needle, and care is taken to pass each needle through the skin on either side of the wound from within outward. If we select a proper time for operation, i. e. not immediately after the injury and if there is no fluid in the joint. If we take every care in sterilizing the skin, and especially in thoroughly softening and cleansing the thickened parts over the patella, and if we redouble our aseptic precautions, I am confident that we can operate on the knee joint without undue anxiety and our results will almost always be satisfactory.

## FERMENT DIAGNOSIS (ABDERHALDEN) FOR CANCER

By CHARLES GOODMAN, M. D., F. A. C. S. AND SAMUEL BERKOWITZ, M. D. NEW YORK

SEVERAL thousand tests by dialysis after the method described by Emil Abderhalden and his co-workers have now found their way into the literature. While conclusive evidence of the merits of the test are substantiated by some authors, there are others who up to the present time have not been convinced of the reliability of the test in their hands and therefore question its practicality for clinical purposes. A critical review of the reports of some of these writers makes it apparent that all the details of the technique described and laid down by Abderhalden have not been mastered and complied with. The technique is intricate, and the outcome of the test depends upon the scrupulous observance of each and every detail, however minute.

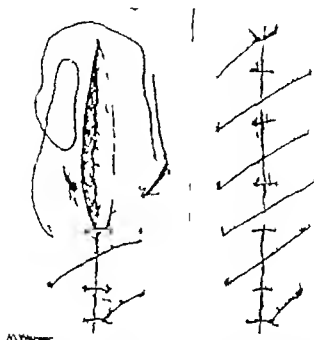
Some of the earliest workers have improved their results by acquiring a corrected technique from Abderhalden or from one of his pupils, and until the details of the test have become simplified the most reliable statistics of the dialysis test will necessarily be derived from those who have received such instruction.

That the action in this test is due to blood ferments was shown in 1909 by Abderhalden, working with Pincus and Weichert. Abderhalden was guided by his belief that the presence of foreign substance in the circulation is conducive to the production of antagonistic or protective bodies. That this holds true not only in pregnancy but also in other conditions has been shown by many observers, and we find that

Zeitschr. Biol. 1909, 5, 6

## SKIN SUTURE

B. CLARENCE L. HILD, M. D. CHS. RAYON, IOWA



A. H. H. H.

THE method of suturing the skin and subcutaneous tissues as shown in the accompanying illustration has the advantage of coupling accurately the skin margins, and at the same time holding the wound securely together.

The deeper stitches distribute the tension over a larger area and the skin edges are held together without tension.

Another advantage is its extreme simplicity and the ease and rapidity with which it can be applied.

## A METHOD OF DRAINAGE IN SUPPURATIVE APPENDICITIS

B. J. A. PETTIT, M. D. PORTLAND, OREGON

IT has been found by many that drainage cases of appendicitis can be handled through

McBurney incision as well as through a more mutilating cut. For a long time the practice of draining these cases close to the drum so that the lateral wall of the abdomen forms one wall of the sinus has been followed out by us. Ample and unobstructed drainage can be made as well in this way as in any other. In Fig. 1 will be seen

the drainage tubes resting close to the skin at the bottom of the split in the internal oblique and transversalis muscles. In suturing these muscles, this split at the base can be left open as far as the judgment of the operator dictates. Figure 2 shows an additional split made in the external oblique close to the skin through which the tubes are drawn. and Fig. 3 shows the tubes emerging in a short cut through the skin close to the anterior

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SEVERAL thousand tests by dialysis after the method described by Emil Abderhalden and his co-workers have now found their way into the literature. While conclusive evidence of the merits of the test are substantiated by some authors, there are others who up to the present time have not been convinced of the reliability of the test in their hands and therefore question its practicability for clinical purposes. A critical review of the reports of some of these writers makes it apparent that all the details of the technique described and laid down by Abderhalden have not been mastered and complied with. The technique is intricate, and the outcome of the test depends upon the scrupulous observance of each and every detail, however minute.

Some of the earliest workers have improved their results by acquiring a corrected technique from Abderhalden or from one of his pupils, and until the details of the test have become simplified the most reliable statistics of the dialysis test will necessarily be derived from those who have received such instruction.

That the action in this test is due to blood ferments was shown in 1909 by Abderhalden working with Pincussohn and Weichert. Abderhalden was guided by his belief that the presence of a foreign substance in the circulation is conducive to the production of antagonistic or protective bodies. That this holds true not only pregnancy but also in other conditions has been shown by many observers, and we find that

Hoppe-Seyler, *Ztschr.* 1909 No. 67

From the Physiological Chemical Laboratory, Beth Israel Hospital, and the Department of Physiological Surgery of the New York University.

## A CONTRIBUTION TO THE DISCUSSION ON INTERNAL DERANGEMENTS OF THE KNEE-JOINT

B. A. H. TUBBY M. S. (LOND.) F. R. C. S. LONDON, ENGLAND

IT is a matter of sincere conviction to me that the great factor in the production of displacements of the semilunar cartilages of the knee is undue lateral movement of the joint, however produced. I would cite causes other than athletic violence. Such are a marked degree of genu valgum in adults and right-angled contraction of the tendo Achillis. The position of the legs in relation to the thighs in the former condition throws an undue strain upon the internal lateral ligament and therefore upon the internal cartilage but the latter that is, right-angled contraction of the tendo Achillis as a causative factor is more difficult to understand. However it depends essentially upon this fact that, given a short gastrocnemius, soleus, and tendo Achillis, the two joints—the knee and the ankle—over which these muscles pass must be temporarily in walking in a state of unstable and hesitating equilibrium at some portion of the stride. The usual result is a suddenly everted foot, and a sprained ankle. Occasionally, the ankle escapes and the stress falls upon the knee-joint, so that the upper end of the tibia is jerked inwards with displacement of the internal cartilage. So firmly convinced am I of the essential share taken by excessive lateral movement in the production of displacement of the semilunar cartilages that I believe, if the undue mobility can be effectually controlled, the necessity for operation is largely discounted. And in support of this statement I may detail my practice in these cases. In an early case I reduce the displaced cartilage under an anæsthetic, accepting as evidence of reduction complete extension of the knee. The limb is then placed in extension in plaster of Paris for three to six weeks to allow the injured parts to settle down and heal. Then an apparatus is fitted which permits limited flexion, but no lateral movement of the joint at all. From time to time the angle of flexion is increased, as the lateral mobility of the knee-joint becomes less marked, until full flexion and extension without pain or difficulty are present and the apparatus is discarded in six to nine months. Like Mr. Jones, I insist upon the early treatment being thorough. One can often gauge the duration of the complete rest required by noting the amount of effusion shortly after the injury. It is easy to understand why there should

be effusion, when we remember that both surfaces of the semilunar cartilages are covered by synovial membrane. If the cartilages are only loosened the amount of fluid forming in the joint is comparatively small, but it is much greater when the semilunar discs are torn or doubled over.

There is one point which is often overlooked in the mechanical treatment of these cases. In the cases of weighty patients, in those with genu valgum or with much lateral movement of the knees, and in long-legged people it is necessary that the apparatus should extend nearly the whole length of the limb, in fact, from the junction of the upper and middle thirds of the thigh to the ground. A short apparatus fails to control the leverage of the limb at the knee, and therefore the joint must be controlled in the way mentioned.

Acting on these lines, I have found it necessary to operate in only five per cent of cases in my private clinic. It would be interesting to hear from Mr. Jones what proportion the cases he has found to require operation bear to those he has succeeded in curing by other methods.

There are many points about these cases still unexplained, such as why pain is felt sometimes over the outer side of the knee when the internal cartilage is damaged, also why in the majority of all knee lesions pain is so persistently located below and to the inner side of the patella. I am clear however that so long as tenderness remains in either of these situations the patient should be advised not to walk and, further in painful cases where operation is required I have often found it a satisfactory procedure to remove the subsynovial tissue on the lower and inner side of the patella.

When I decide to operate, I do so on these grounds:

- 1 Where the patient is unable to give the necessary time, and has not the means to afford the apparatus required for mechanical treatment.
- 2 Where the patient is unable to obtain his livelihood shackled by a splint.
- 3 In the cases of those who go up ladders, work on scaffolds or amongst machinery where a sudden and unexpected fall may be fatal.
- 4 Where a support has been faithfully tried and has failed.

3 The serum must always be centrifuged until no red blood-corpuscles are visible after centrifuging for five minutes. Discolored serum is always discarded as valueless, as it usually gives positive results in negative cases.

4 Great care should be used in handling that part of the *thimble* which will take part in the dialysis. The thimbles used in our tests had been certified at Halle and were repeatedly tested.

The ninhydrin test is so delicate that only scrupulous care in handling the thimbles will avoid reaction due to perspiration or bacterial contamination. *Blowing* the water from the wash bottle, even with great precaution, may contaminate it with small amounts of saliva sufficient to produce conflicting results.

In conclusion one is competent to perform the tests only when such skill is acquired that negative cases are diagnosed as negative.

## A METHOD OF DISTENDING THE VEINS OF THE FOREARM PREPARATORY TO INTRAVENOUS INFUSION OR SALVARSAN ADMINISTRATION

B. A. I. HOGE, M. D. FORT SMITH, ARKANSAS

THE method consists in using an inflatable rubber bag about four inches in width and long enough to encircle the arm (the arm-band from a blood-pressure apparatus answers admirably) with a tube attached leading to a hand pump with a screw escape valve. The arm band is placed in position around the arm, well above the site of insertion of needle or cannula, and after the arm has been prepared the whole may be covered with sterile towels.

When the operator and solutions are ready, the nurse is instructed to inflate the bag with the hand pump. The inflated bag pressing on the arm causes a stasis of the venous circulation without perceptibly obstructing the arterial flow and any desired degree of distention of the obstructed veins may be produced. When the needle has been inserted (closed method) or the vein has been freed and the cannula inserted (open method) the nurse is instructed to turn the screw escape valve, releasing pressure and permitting reestablishment of the venous flow.

The solution may then be permitted to flow in as rapidly as is desirable.

The advantages claimed for the method are

That the degree of distention is easily controlled. This is not possible with an ordinary tourniquet, which is often tied too tightly thus stopping both arterial and venous flow, or tied not tightly enough, causing insufficient distention.

That there is no fumbling with knots. The entire procedure is controlled easily and well away from the site of operation.

That there is no jarring of the arm in releasing the obstruction. After the needle has entered the vein the arm is not jarred in releasing the obstruction and the risk of displacing the needle is thus prevented.

That there is minimal danger of injuring the intima of the obstructed vessels.

This method might also be used to advantage in securing hemostasis in operations on the fingers, the forearm *et cetera*.

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either dead or not viable (amounting to about 50 per cent in hospital cases of placenta prævia). After eliminating these cases, very few remain for caesarean section.

In desperate cases caesarean section may be the only available method. Webster<sup>1</sup> reports a case in a girl 14 years of age with copious hemorrhages, infantile vagina and narrow pelvis in which he operated successfully for the mother.

The modification of the classical caesarean section

2 *The extraperitoneal caesarean section* is recommended by Sellheim in aseptic cases with living child and no great hemorrhage. But even in such cases extraperitoneal caesarean section cannot be said to offer good prospects inasmuch as the incision is made through the maternal portion of placenta with its enormous sinuses. Hofmeier contends that the vascularity at this point is no greater than that of any other part of the uterus. That this view does not agree with the anatomical facts I have shown at the International Congress at London in 1913. Hofmeier's view has been obtained through examination of poorly injected specimens.

3 *Vaginal caesarean section* is Dührsen's modification of accouchement force as practised by French obstetricians of the seventeenth century by Guillemeau and Mauriceau in cases of hemorrhage during pregnancy. Both the accouchement force and vaginal caesarean section have the disadvantage that the incision is made through the placental site by reason of which large maternal vessels are opened. As the incision is made in the interest of the child extraction must be rapid and in consequence and favored by the porous nature of the tissues of the low rupture segment the incision is enlarged by tearing so that we have enormous hemorrhage to contend with after the extraction of the child. The placenta must be rapidly removed so that the incision and the lacerations can be quickly sutured. The suturing is usually difficult the uterine and torn edges cannot be held by ligatures as the latter tear cut when downward traction is made in them the extensive bleeding meanwhile

making orientation impossible. Furthermore, the hurried removal of the placenta tends to cause atony of the uterus which encourages severe bleeding much to the damage of the already greatly depleted patient.

The results, therefore were bad and former advocates of the method such as Bumm and Krönig now warn against it.

It is significant that even Dührsen, the one who originated the method has modified it in cases of placenta prævia and extends the cervical incisions only so far that the metruosyrter can be introduced into the cavity of the uterus. The uterus also must not be pulled down Dührsen says but should simply be fixed to prevent separation of placenta.

In remarkable contrast to the bad experiences of other operators are the results given by Döderlein's Clinic 34 vaginal caesarean sections with one death.<sup>2</sup> In Döderlein's compilation at the International Congress London we find 28 cases with 9 maternal deaths, 3 of the children were stillborn and 44 not viable. According to Döderlein the total mortality of the mothers was 31.3 per cent, of children 21.7 per cent.

4 *Métrotyris*. Originally a rubber bag (Barnes-Keller) was introduced into the cervical canal below the amniotic cavity and then filled. Its object was to check bleeding and induce pains. The effect as far as pains are concerned is very uncertain and the introduction of the bag between amniotic cavity and uterine wall certainly causes a further detachment of the placenta as is evidenced by the bleeding which follows the removal of the bag. Dührsen modified the procedure by introducing the bag into the amniotic cavity after the membranes had been ruptured or the placenta (in case of central insertion) perforated. The intra-amniotic métrotyris will check the bleeding as surely as the binding down of the foot but it will cause circular compression of placenta. The most practical of the bags for this purpose is that of Champetier de Ribes as it is made of porous elastic material and can be filled to its fullest capacity. Traction can be made on the tube by means

<sup>1</sup> Webster's and Textbook of Obstetrics, 2d

<sup>2</sup> Döderlein, 1. Gynäk. B. 20.

## ABDERHALDEN REACTION IN CANCER

Cases Numbered	Clinical Source Each Test	Time of Diagnosis (Months)	Serum - Control	Serum + Carcinoma	Serum + Carcinoma	Serum + Melanoma	Serum + Myeloma	Serum + Leukemia	Serum + Anemia	Serum + Polycythemia	Serum + Unknown	Clinical Diagnosis	Remarks
D 10	2	18		+								Recurrent carcinoma breast	
M 1	0	8		++								Carcinoma intestine	Post mortem
M 1	0	10		++								Carcinoma breast	Operated
M 3	1	18		++		+++						Retroperitoneal sarcoma	Post mortem
B 14	3	18		++								General carcinomatosis	Marked cachexia
B 15	3	30		+++								Tumor abdomen	Carcinoma, stomach, op
B 16	5	6		++								Sarcoma testes	Hydrocele fluid
B 7	5	90	0	++		+						Carcinoma liver	Refused exploration
M 18	5	24		++		++						Sarcoma femur	Section typical
M 9	5	24		+		+						Carcinoma uterus	+ Wassermann
M 20	5	24		+								Carcinoma breast	Operated
M 31	3	24		0		++						Retroperitoneal sarcoma	Ambie fluid post mortem
M 33	3	16		0								Retroperitoneal sarcoma	Blood serum
P 1	6	24		++								Post-op carcinoma breast	4 years, no recurrence
P 4	6	8		++								Recurrent carcinoma breast	
P 5	1	8		++								Carcinoma stomach & liver	Operated
P 6	0	20		++								Carcinoma stomach	Operated
B 42	0	24		++								Carcinoma stomach	Refused operation
M 33	5	20		++							+	Carcinoma recti	Post mortem
M 34	5	24		++								Carcinoma liver	Post mortem
P 4	5	20		++								Carcinoma stomach	Operated
B 43	5	6		++								Carcinoma breast	Operated
B 44	0	24	0	++								Carcinoma liver	Refused operation
B 45	5	24		+								Carcinoma recti	Refused operation
B 46	0	24		+								Carcinoma breast	Operated
M 38	0	24		+								Carcinoma liver	Ambie fluid post mortem
B 5	5	24		+								Carcinoma stomach	Refused operation
B 53	5	24		++								Carcinoma stomach	Operation
B 53	5	24		++								Carcinoma stomach	Operation
B 54	5	24		++								Carcinoma stomach	Operation
B 55	5	24		++								Carcinoma stomach	Operation
B 57	5	24		++								Carcinoma pancreas	Marked jaundice refused operation
P 5	5	24		+								Carcinoma recti	Operation

syphilis, brain abscess, meningitis, Basedow's disease, and cancer are among the diseases which are readily diagnosed by this method.

Recently we reported that we had found in the blood following the transplantation of the thyroid gland a ferment which was capable of digesting suprarenal.

In a series of cases of malignancy we were able to obtain 30 reactions out of 33 cases in which the results corresponded to operative, post-mortem and clinical findings. In the accompanying table one case of carcinoma was not diagnosed and one negative case was diagnosed as a sarcoma.

The imperative precautions asserted themselves with each step in this difficult procedure. Among those which should receive special mention are

1. *Absolute asepsis* must be carried out in all the details of the test. *Especially cleanliness* must be observed in caring for the glassware.

2. The *substrate* (antigen) must be tested before each series of reactions, to a bad error from this source. Failure to macerate properly or to idle the tissue in the preparation of the substrate seems to be a frequent source of error. For the purpose of maceration an ordinary meat chopper serves very well, since connective tissue usually becomes stringy and can easily be removed. The tissue should be divided into minute pieces, and not into pieces the size of a silver quarter or a bean as noted by other writers, for the point has been emphasized by Abderhalden that unless the tissue has been minutely divided before boiling it cannot be entirely freed from blood.

in any sense. It is rather a detailed study of clinical entity served in the form of textbook. In the present state of flux of opinion concerning infantile paralysis, a textbook written on this subject comes with rather an acute shock of surprise. With so much developing each few months regarding the pathology of acute poliomyelitis one cannot but admire the hardihood of the authors of this volume in setting forth the present state of our knowledge.

In the book are many interesting treatments and studies, especially worthy of note is the part devoted to the discussion of the epidemic appearance of this disease. Manning, who has contributed this portion of the work, gives a careful analysis of the Wisconsin epidemic of 1905. It also reviews the epidemics and pandemics.

In the etiology or exciting cause of infantile paralysis the authors state that the theory of the disease being induced by the action of chemical toxin ingested in the form of decomposed animal matter has never been supported by scientific investigation, and that this theory has fallen to the ground owing to the demonstration that the disease could be transmitted from one living host to another.

The portion of this volume devoted to therapy is exceedingly interesting to the orthopedic surgeon. Fraenkel emphasizes the value of physical therapy, massage and passive motion. He relies almost entirely upon this department in the treatment of paralysis, and does not, as is the rule in works on poliomyelitis, go into an elaborate description of operative procedures. In this he sounds an important note and one that might well be heeded by many orthopedic surgeons. The surgery of tendons, muscles and nerves has been so extensively exploited of late, in relationship to the treatment of infantile paralysis, that we are in danger of losing sight of the fact that much can be done for these patients by properly carried out physical, venesection and mechanotherapy. N. A.

STERN'S attempt to base rational understanding of the theory and practice of bloodletting on an intimate acquaintance with its history is surely highly commendable. In thirty-eight pages devoted to the history of venesection he covers some of the interesting infirmities. The fate of the procedure through the past ages has been romantic one. It one time practiced as cure for all ills then fallen almost altogether into evil repute later

revived until to day it takes its place as a well recognized therapeutic measure.

The author hurriedly reviews the bloodless and bloody methods of venesection and grows enthusiastic over venepuncture with a specially constructed needle of his own. His enthusiasm will not be shared by many. The exposure of a vein with the introduction of a small cannula is such a simple, safe and sure procedure for removal of blood and a subsequent infusion that it will, to our mind, remain the favorite operation.

In spite of the author's prefatory assurance that he does not see in venesection a universal panacea, the critical reader will surely feel that his championship of the cause borders on fanaticism. His report of one case of chronic morphinism cured by two venesections is a brilliant example of a faulty conclusion arrived at by the *post hoc* route. The plea that runs through the clinical portion of the treatise, like a scarlet thread, that venesection should be employed early and not solely as an *adjuvant* *reflexus* makes a strong appeal to anyone who gives the matter any thought. Even in a short review one cannot help again calling attention to Stern's uncritical devotion to the method. L. S.

OSTMAN'S work on the fundus oculi is done in three volumes, the first of which consists of 393 pages of text with 34 illustrations and 4 colored plates. The second and third volumes are portfolios, the second containing 8 diagnostic cards and 35 stereograms and the third 44 stereograms. A stereoscope accompanies the work.

The author first describes the method of ophthalmoscopic examination, then the appearance of the normal fundus and then takes up the changes that are found. In addition to the accompanying illustrations, references are made to the corresponding stereogram. The text is very good, as are also the illustrations. As to the stereograms, they serve a most useful purpose in demonstrating to students and those expert in the use of the ophthalmoscope conditions which may be found in the fundus. But the reviewer found that many of them accentuated too much the concavity of the fundus. In cases where there was actually difference in the curves of the lesion and the fundus, such as choked disc and glaucoma, the stereograms bowed this excellently. The work is a valuable addition to ophthalmic literature. C. L.

THEORY AND PRACTICE OF BLOODLETTING. NACK, 1895. ARTHUR STARR, M.D. UNIVERSITY OF CHICAGO. By HENRIK FREDERIK CHRISTENSEN. 1905.

DIAGNOSIS OF THE FUNDUS OCULI. By Edward L. Ostman. M. D. Troy, N. Y. The Southworth Co. 1905.

# BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS IN SURGERY

By MAJOR G. SETLIG M D St Louis

THERE can be no question regarding either the why or wherefore in the case of *The Practice of Surgery* written by Howard. The author furnishes us with all necessary information on this score plants his standard as it were in the very first sentence of his preface, which reads: "This textbook has been written at the request of many past and present students of the London Hospital. The main objects of the book are to give the student an introduction to surgery and to prepare him for his final examinations in that part of the medical curriculum."

The book is large and on the whole satisfactory full. It has a flavor so obviously its own that it cannot escape even a casual reader the thoughtful reader will of course note at once that this is due to the author's deliberately planned and carefully executed didactic onslaught. He literally bombards his students with tabulated data, and coddles them with the deadly parallels of differential diagnosis, till one almost grows to fear that on the next page he will be furnished with "pathy mnemonic on which to hang some complicated lot of information." One cannot help feeling that the student of London Hospital who knows Howard's book will not fail to pass his final examination in surgery. Not a word of this is said by way of disparagement of the book. It is really an excellent teaching of me written in the minutely interesting style of the English clinician, well balanced, well classified, judicial and rational in tone, with practically no significant omissions, and without even the suspicion of unwarranted dogmatism.

The make up of the volume is so like that of Ashhurst's work, reviewed in this department a few months ago, that we need not specify the exact manner in which the chapter heads have been divided. That it is a better book for its purpose than is Ashhurst's, is due to the palpably more intensive effort on Howard's part to clarify every subject that he handles. One may fairly judge from reading the book that the reason the students of London Hospital requested Mr. Howard to write it lies in the fact that he is a gifted teacher. Yet still, he has striven very largely even if more successfully along the lines laid down by Ashhurst, namely to teach his students to know. He and

Ashhurst both are doing that very thing which has brought purely didactic teaching into so much undeserved obloquy and discredit. They furnish the essential facts they attempt to furnish the necessary thumb racks necessary to fix the facts in memory but they fail to develop strongly the only method of really valuing facts namely a clear exposition of the various premises upon which the final conclusions of fact rest. Let us furnish just one example for the sake of concreteness. Under the head of peritonitis Howard has various types of classification of symptoms and treatment. The subject matter is meaty and well ordered, so as to be easily memorized, but there is not a word regarding extent of peritoneal effusion, absorption power lymphatic and blood supply stomata protective bacteria, adhesive power or any one of numerous other fundamental facts, from a full knowledge of which student could be taught to reason out conclusions on a rational basis. There is only one way to rob medicine of the undesirable element of mysticism which more or less shrouds it even to day and that way consists in constantly hammering on the subject of rational thought. Primitive man interpreted disease as manifestation of evil spirits, and Gerson in his excellent *History of Medicine* adroitly emphasizes this fact by pointing out that this false reasoning rested ultimately on primitive man's failure to establish any causal relationships between a natural object and its moving shadow. Failure to establish causal relationships leads to error to day exactly as it did in the Neolithic era, and it is therefore necessary for every teacher to tell his students why it shows them why and to stimulate them to inquire why. Howard has not done this, but he has done what he set out in his preface to do.

BY way of contrast with the preceding volume, this book by Frazer and Manning stands out sharply. The history of infantile paralysis has been written so often and so well that the authors wisely lay little stress on this phase of the subject. The book is not a summarizing, not a restatement of the problem, not, in other words, encyclopedic.

A MANUAL OF INFANTILE PARALYSIS WITH MODERN METHODS OF TREATMENT, INCLUDING RATIONALE AND NEW TREATMENT OF OTHER TROPICAL DISEASES. By Henry W. Frazer, M.D., and George C. Manning, M.D. Philadelphia: F. A. Davis Co. 1914.

THE PRACTICE OF SURGERY. By Russell Howard, M.D. (Lond.) F.R.C.S. Philadelphia and London: J.B. Lippincott Co. 1914.

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Books received are acknowledged in this department, and each acknowledgment must be regarded as sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

KURZGEFASSTES HANDBUCH DER GEBÄRTEN LEHRE, GYNÄKOLOGIE UND GEBÄRTENHILFE FÜR DIE PRAKTIKUM ABT. By W. Lefmann. Volume III. Theorie und pathologische Gynäkologie des Weibes, by Dr. Ludwig Lefmann. Physiologie und Pathologie der Geburt, by Dr. Emil Th. Juchs. Leipzig: J. C. W. Vogel, 914.

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days of the puerperium a rise of temperature up to 40° C. partly complicated with foul smelling discharge. In those cases the uterine cavity was always douched thoroughly with a one-half per cent solution of lysolol and all patients recovered.

Sixteen of the children were born alive while 35 of them were still born (two of them being twins). In 10 cases the fetus died during labor. 23 of the 35 still born were immature.

Concerning the technique I performed bipolar version as early as possible when only one or two fingers could be admitted through the os and brought down a foot. I placed a loop around same and left the case to nature.

As long as the liquor amnii has not escaped and the fetus is movable the operation is by no means difficult.

When the placenta covered the os completely I borrowed the fingers right through it into the amniotic cavity. The perforation of the villi and chorionic membrane is not difficult, but the perforation of the amnion sometimes proves so which can be avoided by pressing the presenting part with the abdominal hand against the pelvic brim, while at the same time the vaginal fingers rub gently the membrane upon the presenting part until it tears. I grasp the first obtainable foot, no matter if it is the anterior or posterior one and bring it down into the vagina chiefly by means of the abdominal hand, namely in the beginning of the first stage with the abdominal wall and the uterus through anesthesia not to such extent that the abdominal hand can push the foot so to speak through the os when upon it can be seized between the thumb and index of the vaginal hand. Now for the foot can be pulled down into the vagina depends upon the dilatation of the os. It would for instance be a mistake to try to pull the breech immediately into the pelvic brim without recognizing the size of the os. Otherwise severe laceration of the cervix and haemorrhage would occur which would be blamed upon the method. By partially dilated os, the leg must not be pulled down further than to above the knee, which will be sufficient to check bleeding. Should any haemorrhage occur when the os

has become more dilated the foot may be drawn slowly until plugging again is complete after this the expelling of the fetus is once more left to natural forces. An extraction is only then justified when the os is fully dilated and the child still alive.

No. 1 Journal No. 931 February 26, 1881 Name D Age 30 XI para (bottions included) presentation of fetus II Vert. placenta previa lateral, dent labor last menstruation middle of August 1880 Periodical bleeding during last 10 months Profuse bleeding for 6 hours Very anæmic Temp 98.8 Pulse 120 Protrusion of weak pulsating cord Os almost fully dilated Bleeding stopped after version is completed Slow traction of fetus Placenta manually removed operation, internal crural extraction child male dead, immature (seventh month) per part m. normal

No. 2 Journal No. 94 February 29, 1881 Name Ch Age 35 VIII para (bottions included) presentation of fetus, vertex, placenta previa total 1 line last menstruation June 1880 Haemorrhage for 6 days Profuse bleeding for five hours Very anæmic, fainting Os dilated to the size of a half dollar 11 diameters Two fingers through the placenta Child dead After crural bleeding stopped T 9 hours later fetus expelled Placenta spontaneously 1 to parts without haemorrhage operation completed crural child male dead mature puerperium normal

No. 3 Journal No. 95 March 1881 Name J Age 2 V para (bottions included) presentation of fetus, II V n Placenta previa lateral sinistra labor came 1 time 11 history of haemorrhage for three weeks vagina plugged for the last eight days For 6 hours strong pains with profuse haemorrhage extremely anæmic Protrusion of weak pulsating cord Os size of dollar After crural no bleeding 6 hours later fetus expelled Placenta born about bleeding operation completed crural child male dead puerperium path died three hours later from exsanguination

No. 4 Journal No. 96 May 3, 1881 Name D Age 4 VII para (bottions included) presentation of fetus I Transverse position Placenta previa lateral sinistra labor profuse haemorrhage for three hours Membrane ruptured 6 hours Protrusion of pulsating cord and right arm Os size of dollar After crural no bleeding strong pains fetus expelled shortly after delivery of head Placenta about bleeding operation completed crural child female dead puerperium normal

No. 5 Journal No. 97 May 7, 1881 Name K Age 2 II para (bottions included) presentation of fetus I Transverse position Placenta previa central labor last menstruation beginning of September 1880 Slight bleeding for few days On May 7th strong pains set in with profuse haemorrhage Os admitted two fingers After crural

no bleeding Three hours later fetus extracted and expressed by fully dilated os Placenta without bleeding operation, combined version, extraction child, male, dead, immature, puerperium, normal

No. 6 Journal No 54, May 23, 1888 Name, P Age 39 VII para, presentation of fetus, II. Foot presentation Placenta prævia lateral, dextr labor last menstruation middle of October 1887 Severe bleeding for twelve hours Temp 38.5 Pulse 90 Os size of one-half dollar Left foot pulled down until bleeding stopped Six hours later os fully dilated Fetal sounds still to be heard, therefore, extraction. Placenta without bleeding, slight atony p.p., operation, pulled down a foot Extraction child, male, dead immature puerperium, normal

No 7, Journal No 100, June 5 1888 name, J Age 33 VII para (abortions included) presentation of fetus, I Vertex Placenta prævia lateral Sinister; labor last menstruation November 6, 1887 Periodical bleedings for four weeks Pains and hemorrhage for twelve hours Os size of quarter Bleeding stopped after version Fetus expelled spontaneously soon after operation combined version, child, male living, length 43 cm Circumference of head, 3 cm (died three hours later) puerperium, normal

No 8, Journal No 273 July 14, 1888 Name M Age, 8 I para (abortions included), presentation of fetus, I Vertex, placenta prævia later sinistra labor last menstruation beginning 1 December 1887 Profuse bleeding for two days, very anæmic Strong hemorrhage and collapse during version Fetus expelled two hours later Placenta bimanually removed Packing of uterus and vagina Bleeding checked operation, combined version child male dead, immature puerperium, patient died two hours later from exsanguination

No 9, Journal No 53 July 9 1888 Name B Age 30 VII para (abortions included) presentation of fetus, I Vertex Placenta prævia, centralis labor last menstruation beginning of November 1887 The morning of July 9 suddenly profuse bleeding os admits no finger Hydramnion bleeding stopped after version Fetus expelled four hours later Operation combined version child female dead, mature puerperium normal

No 10, Journal No 36 July 8 1888 Name W Age 35 III para (abortions included) presentation of fetus, II Foot presentation placenta prævia margin sinister, labor came to me with temp 38 Pulse 104 Profuse bleeding when os fully dilated After labor slight atony operation extraction child, female living mature puerperium, normal

No 11, Journal No 320 July 8 1888 Name L Age 30 II para (abortions included), presentation of fetus, II Vertex placenta prævia later sinister labor last menstruation end of November 1887 Profuse periodical bleeding for six hours pains slight Os admits no fingers Bleeding stopped after version Fetus expelled two hours later operation combined version child male, dead, mature puerperium, normal

No 12, Journal No 326 July 30, 1888 Name B Age 30 VI para (abortions included) presentation of fetus, II Vertex, placenta prævia, central labor last menstruation December 4, 1887 Profuse hemorrhage Os almost fully dilated, covered with placenta. Went through placenta, performed version and extraction. Placenta bimanually removed operation, internal version, extraction child male, dead immature puerperium, temp first day 36.5 second day 38 third day, 40 1 Pulse 140 (Uterine cavity washed out) Evening temp 39 Fourth day 38 fifth day 36.9 Temp remained normal Recovery

No 3 Journal No 419, September 1 1888 Name, R Age 39 IV para presentation of fetus, II Vertex Placenta prævia centralis labor last menstruation middle December 1887, severe bleeding for four hours Os size of dollar No bleeding after version Fetus expelled seven hours later Arms and head artificially delivered Placenta without bleeding operation, combined version child, female, living, mature puerperium, normal

No 14 Journal No 466 September 5, 1888 Name, K Age 3 VII para (abortions included) presentation of fetus II Vertex Placenta prævia lateral, sinister labor last menstruation beginning of January Two hours ago very profuse bleeding, so that she fainted Very anæmic Os size of a dollar Bleeding stopped after version fetus expelled few hours later operation, combined version child, female, dead immature puerperium, normal

No 5 Journal No 378 October 4, 1889 Name, G Age 30 I para (abortions included) presentation of fetus, transverse position Placenta prævia centralis labor last menstruation beginning of March Profuse bleeding for some hours After version no bleeding Fetus expelled three hours later Placenta spontaneous one half hour later without bleeding operation, combined version child, female, living, immature (died the following day) puerperium, normal

No 6 Journal No 385 October 29 1889 Name Sch Age 7, III para (abortions included) presentation of I Vertex Placenta prævia later sinister labor last menstruation January For three hours severe bleeding Anæmic Os size 1 half dollar After version no bleeding fetus expelled one and one half hours later Placenta spontaneous without bleeding operation combined version child, female, dead, mature puerperium, normal

No 7, Journal No 400 October 29, 1889 Name Sch Age 38 V para (abortions included) presentation of fetus, vertex Placenta prævia later sinister labor last menstruation end of February Severe bleeding Twins After extraction of children no bleeding Placenta bimanually removed Uterus hereafter firmly contracted and no bleeding operation combined version and extraction, children, females both dead length 30 cm puerperium, normal

No. 18 Journal No. 415 November 5, 1890; Name W. Age 37 VI para (abortions included); presentation of fetus I Vert. Placenta previa, marginal labor last menstruation December 1883. Profuse bleeding for 10 hours. Liquor amni escaped. On leas the hand through. Child dead. Bleeding stopped after craniotomy. Placenta spontaneous expelled one-half hour later without bleeding. Piece of membranes removed operation, internal craniotomy and slow extraction child female dead puerperium normal.

No. 19 Journal No. 433 November 25, 1890; Name Sp. Age 20 III para (abortions included); presentation of fetus II. Incomplete foot presentation. Placenta previa, lat. ralis labor last menstruation end of March. Moderate bleeding, prolapse of posterior left leg. On twice the size of a dollar. Left foot pulled down, which rotated in front under strong pains. No bleed. g after breech entered pelvis. Third time (about bleeding); operation, pulled down a foot child, female dead, length 43 cm puerperium normal.

No. 20 Journal No. 433 November 25, 1890; Name II. Age 41 VI para (abortions included); presentation of fetus II. Vertex. Placenta previa central labor last menstruation April. Bleeding for last 20-24 hours. Hemorrhage with every pain. Fetus dead. On size of dollar covered all over the placenta. Went through the placenta. Fetus slowly extracted. Placenta expelled shortly after without bleeding operation combined version, at action child, male dead immature puerperium normal.

No. 21 Journal No. 460 November 20, 1890; Name II. Age 35 IV para (abortions included); presentation of fetus I. Transverse presentation. Placenta previa lateral dist. labor last menstruation beginning of March, bleeding for five hours. Liquor amni escaped. On size of quarter. Bleeding stopped after craniotomy. Fetus expelled two hours later. Placenta delivered without bleeding operation, combined craniotomy child female living puerperium normal.

No. 22 Journal No. 465 November 30, 1890; Name L. Age 31 para (abortions included); presentation of fetus II. Vertex. Placenta previa lateral, anterior labor last menstruation March 3. Bleeding for fourteen days very profuse for two hours. Very nervous. On admitted two fingers. After version no bleeding. Fetus expelled four hours later. Collapse after child is born. Placenta expressed operation combined craniotomy child female living length 47 cm puerperium normal.

No. 23 Journal No. 5 December 2, 1890; Name D. Age 5 I para (abortions included); presentation of fetus I. Vertex. Placenta previa lateral anterior labor last menstruation May 21. Bleeding with pains for eight hours. On size of quarter. No bleeding after version. Fetus expelled three hours later. Placenta delivered without bleeding operation combined version child, male dead, length 46 cm puerperium normal.

No. 4 Journal No. 531 January 1, 1890; Name II. Age 27 II para (abortions included); presentation of fetus II. Vertex. Placenta previa lateral anterior labor last menstruation May 4th. Severe hemorrhage for two hours. Temp 105. Fetal sounds lost. On size of dollar. Bleeding stopped after version. Fetus expelled four hours later. Placenta without bleeding operation, combined craniotomy child, female dead immature puerperium, normal.

No. 5 Journal No. 575 January 20, 1890; Name Sch. Age 36 VIII para (abortions included); presentation of fetus II. Transverse position. Placenta previa total labor last menstruation end of June. Bleeding for several hours. Anæmic. On size of dollar. After version no bleeding. Fetus expelled two and one-half hours later. Placenta without bleeding operation, combined version child, female dead, immature; puerperium, normal.

No. 26 Journal No. 611 February 6, 1890; Name F. Age 28 VI para (abortions included); presentation of fetus II. Transverse position. Placenta previa lateral anterior labor last menstruation not known. Profuse bleeding for four hours. On admitted one finger. After craniotomy bleeding. Fetus expelled three hours later. Placenta without bleeding operation, combined craniotomy child, female, dead, immature (nigh month) puerperium, normal.

No. 27 Journal No. 637 February 2, 1890; Name B. Age 38 IX para (abortions included); presentation of fetus I. Vert. 2. Placenta previa lateral anterior labor last menstruation December 6, 1889. Profuse bleeding for 10 hours. On size of dollar. Strong pains head engaged pelvic brim. Bleeding stopped after membranes ruptured. Fetus expelled three hours later. Placenta without bleeding. Patient collapsed soon after but rallied operation ruptured membranes child, female living puerperium, normal.

No. 8 Journal No. 7 March 24, 1890; Name M. Age 30 VI para (abortions included); presentation of fetus II. Vertex. Placenta previa central labor last menstruation August 15, 1889. Severe bleeding for some hours. On size of quarter. After craniotomy no bleeding. Fetus expelled two hours later. Placenta without bleeding operation, combined version child male dead, length 4 cm puerperium, normal.

No. 29 Journal No. April 1890; Name R. Age 43 VI para (abortions included); presentation of fetus II. Vertex. Placenta previa central labor last menstruation July 3, 1889. Severe bleeding for hours. On size of quarter. Fetal sounds heard. Bleeding stopped after version. Fetus expelled one and one-half hours later. Placenta without bleeding operation, combined craniotomy child female dead immature puerperium normal.

No. 30 Journal No. April 6, 1890; Name Sch. Age 37 VIII para (abortions included); presentation of fetus I. Vertex. Placenta previa lateral labor last menstruation beginning of August 1889.

Sev. bleeding for two hours. Os admitted two fingers. Bleeding stopped after erosion. Foetal position good. Fortes expelled in 10 hours later. Placenta with slight bleeding operation combined version child male living mature puerperium, normal.

N 31 Journal No. 50, April 23 1890 Name Sch. Age 25 VI para (abortions included) presentation of fetus I Vertex Placenta prævia centralis labor last menstruation August 2 89. Slight bleeding during last three days. Severe bleeding for 10 hours. Anæmic. Fortes dead. Os size of dollar. N bleeding after erosion strong pains. Fortes expelled one half hour later. Placenta with slight bleeding operation, combined erosion child female dead, mature puerperium, from the third to the 34th day foul smelling discharge and rise of temperature. Intra uterine douching. Recovery.

No 32 Journal N 73, April 7 890 Name K. Age 31 II para (abortions included) presentation of fetus, erica Placenta prævia lateral sinister labor last menstruation end of September 889. Severe bleeding for last 10 hours. Liquor amni escaped ten hours ago. Os admitted 2 fingers. Bleeding stopped after erosion. Fortes expelled under strong pains three hours later. I the third to get severe bleeding due to tons. Placenta expelled operation combined erosion child female dead, mature puerperium normal.

N 33 Journal N April 20 1890 Name T. Age 34 VIII para (abortion included) presentation of fetus I Vertex Placenta prævia lateral dextr labor last menstruation July 4 890. Slight perineal bleed g during last four weeks. Pains began last night with sev. hemorrhage. Os admitted 2 fingers. N bleeding after erosion strong pains. Fortes expelled four hours later. A phlegm but rallied. Profuse hemorrhage on third stage. Placenta torn walls removed operation combined erosion child male living mature puerperium normal.

N 34 Journal N 4 VI 6 890 Name B. Age 31 III para (abortion included) presentation of fetus I Vertex Placenta prævia centralis labor last menstruation end of August 890. Period of bleed g during last four weeks. Constant slight bleeding for week. Os size of bill. N bleeding after erosion. Fortes expelled under strong pains one half hour later head felt red. Placenta with out bleed g operation vent neck erosion child female living length 45 cm circumference of head 35 cm puerperium normal.

N 35 Journal N 4 VII 4 890 Name B. Age 31 IV para (abortion included) presentation of fetus I Vertex Placenta prævia centralis labor last menstruation October 890. Bleeding during last week. High pains. Fortes expelled 10 hours later. Placenta with out bleed g operation vent neck erosion child female living length 45 cm circumference of head 35 cm puerperium normal.

N 36 Journal N 247 July 6 1890 Name Tr. Age 30 IV para (abortions included) presentation of fetus I Vertex Placenta prævia centralis labor last menstruation September 31 1890. Bleeding for first time three weeks ago. Periodically severe bleeding for some hours and during examination Os size of half dollar. Abundant liquor amni. Bleeding stopped after version. During expulsion of fetus retracted hemorrhage. Extraction of fetus by almost fully dilated os. Anæmic during third stage operation, combined version child, male dead length 50 cm puerperium patient very anæmic. On the fourth day rise of temperature and foul smelling discharge. Transportation to clinic. Recovery.

No 37 Journal No 268 July 16 1890 Name L. Age 30 IV para (abortions included) presentation of fetus II Vertex Placenta prævia lateral dextr labor last menstruation middle of December. Bleeding interval for some days especially during pains that day was called. Os size of dollar. No bleed g after erosion. Placenta expelled immediately after fortis operation, combined erosion child female dead mature puerperium normal.

N 38 Journal No 207 July 8 890 Name K. Age 4 IV para (abortions included) presentation of fetus II Vertex Placenta prævia centralis labor last menstruation not known. Hemorrhage for 10 hours. Os size of dollar. No bleeding after erosion. Fortes expelled an hour later. Placenta without bleeding one half hour after expulsion of fetus operation combined erosion child male dead mature length 55 cm puerperium normal.

N 39 Journal N 305 September 6 1890 Name K. Age 31 VI para presentation of fetus II Vertex Placenta prævia lateral sinister labor last menstruation beginning of January. Bleeding on yesterday bleeding for some hours so severe that mud I ruptured the membranes. Very anæmic. Os size of dollar. Bleeding stopped after erosion. Fortes expelled one hour later. Placenta torn walls removed. Anæmic operation combined erosion child male living length 55 cm circumference of head 46 cm puerperium normal.

N 40 Journal N 44 September 6 1890 Name M. Age 31 VI para (abortion included) presentation of fetus II Vertex Placenta prævia centralis labor last menstruation in file of December. During last months of pregnancy several times bleeding and threatening abortion. Bleeding intervals for hours. I m. 2nd prod. se. hemorrhage on size of dollar. No bleed g after version. Fortal sound to be heard. Fortes expelled 10 hours later. Placenta three quarters of an hour later. Pains of first third hours with severe operation combined erosion child female length 55 cm circumference of head 55 cm puerperium slight pain during 3rd days recovery.

N 41 Journal N 1 November 8 890 Name C. Age 31 para (abortion included) presentation of fetus I Vertex Placenta prævia lateral sinister labor last menstruation

beginning of 31 y 1891. Liquor amnii escaped three days ago since then slight bleeding at intervals, strong bleeding at arrival. Temperature rising for last 12 hr. hours, now temperature 38.4 C. Pulse 14. On size of quarter. Fetus expelled four hours later. Placenta without bleeding operation pulled down a foot, child, male, dead, mature postpartum shortly after labor temperature 38.1. Pulse 116. Recovery.

No 42 Journal N 350, November 23, 1891. Name H. Age 36 VIII para (abortions included) presentation of fetus II. Vertex. Placenta previa centralis labor 11 menstruation middle of March. Severe bleeding for several hours. Very anemic. On size of the size of a dollar. Membranes not ruptured. Internal erosion through the placenta. Child dead and expelled one half hour later. No bleeding after erosion. Placenta without bleeding operation internal erosion child female mature, postpartum on the fifth day temperature 38.2. Pulse 122 then normal.

No 43 Journal N 505 December 1, 1891. Name Sch. Age 27 VI para (abortions included) presentation of fetus II. Breech presentation. Placenta previa centralis labor last menstruation beginning of March, during last week periodical bleeding. Profuse hemorrhage four hours ago. On size of quarter. During pulsation of fetus bleedings after 11 times fetus born 2 hours later. Night 100y after pulsation of placenta operation pulled down foot child female dead length 31 cm. postpartum normal.

No 44 Journal N 666 January 6, 1892. Name Sch. Age 27 IV para (abortions included) presentation of fetus I. Transverse position. Placenta previa centralis labor last menstruation uncertain. Periodical bleeding for several days. Slight pain. Severe bleeding for few hours. On size of dollar. No bleeding after version. Fetus expelled 1 hour later. Placenta without bleeding operation combined erosion child male dead length 45 cm. mature postpartum normal.

No 45 Journal N 651 Name V. Age 34 VI para (abortions included) presentation of fetus, V. Axes. Placenta previa centralis labor last menstruation uncertain. No bleeding for some hours. On size of half dollar. No bleeding after version. Fetus expelled 11 hours later. Placenta without bleeding operation combined erosion child male dead length 45 cm. mature postpartum normal.

No 46 Journal N 3 Name I. Age 27 III para (abortions included) presentation of fetus I. Transverse position. Placenta previa total labor

last menstruation August 1891. Slight periodical bleeding during last six days. On size of half dollar. After version no bleeding. Fetus expelled four hours later. Placenta without bleeding, operation combined erosion child male living immature postpartum, on the third day temperature 38.7. Pulse 120 fourth day temperature 37.1. Pulse 100. Recovery.

No 47 Journal N 755 February 19, 1891. Name Sch. Age 35 IV para (abortions included) presentation of fetus I. Vertex. Placenta previa later deat. Labor last menstruation June 891. Severe bleeding at intervals during last hours. Anemic. On size of one half dollar. No bleeding after version. Fetus expelled six hours later. Placenta without bleeding operation, combined version child female immature (seventh month) postpartum normal.

No 48 Journal N 38 February 20, 1891. Name M. Age 27 II para (abortions included) presentation of fetus I. Vertex. Placenta previa lateral labor 11 menstruation beginning of June 1891. Periodical hemorrhages during last five hours. First severe. Strong pains. On almost fully dilated. Head in pelvic inlet. After rupture of membranes head descended and bleeding stopped. Fetus expelled shortly after. Placenta without bleeding operation membranes child, male, living length 45 cm. circ of head 31 cm. postpartum normal.

No 49 Journal N 769 February 24, 1891. Name A. Age 29 V para (abortions included) presentation of fetus I. Transverse position. Placenta previa centralis labor last menstruation July 1891. Bleeding 2 February 1891 and 30. Slight pains slight hemorrhage. On size of one-half dollar and covered with placenta. No bleeding after version, no first sound. Fetus expelled one half hour later. After pressure of placenta slight 100y, operation, combined erosion child, male dead length 45 cm. postpartum normal.

No 50 Journal N 700, February 29, 1891. Name M. Age 34 VIII para (abortions included) presentation of fetus I. Vertex. Placenta previa lateral version labor last menstruation May 891. 7 days 90 hemorrhage. Slight pains, for eight hours hemorrhage at intervals. Temperature 37.6. Pulse 100. Night anemic. Strong pains for one half hour. On size of dollar. Head in pelvic inlet. No bleeding after rupture of membranes and head descended quickly. Fetus expelled one hour later. Placenta without bleeding operation ruptured membrane child female living postpartum, on the third and seventh days temperature 41.1. Just smelling lochia. Internal uterine do not. Recovery.

# DEPARTMENT OF TECHNIQUE

## AN OPERATIVE TECHNIQUE FOR RADICAL EXTIRPATION OF VESICAL NEOPLASMS

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THE success of any operation upon the bladder for malignant disease will be judged solely by the end result and the final criterion must be the percentage of cases which survive the primary operation, mortality and remain free from recurrence after the arbitrary time limit.

Statistics demonstrate that resection of the bladder for malignant disease has been so frequently succeeded by recurrence that the usual approach has been inadequate for complete extirpation, or at least in preventing implantation recurrence.

With these ideas in mind it has been our aim to elaborate a technique for the exposure of the bladder and its contained neoplasm that would allow of an extensive resection of the bladder wall adjacent to the growth as well as an orderly plastic repair of the ureters if these should be found involved.

The growth is removed en masse with a wide marching margin of healthy tissue and since it is a matter of record that a functioning bladder has been regenerated where only the trigone has remained after an extensive excision, it is apparent that it is only necessary to conserve the three natural orifices of the bladder: the ureteral orifices and the internal meatus. Considering this anatomic trinity the technique about to be outlined exposes the bladder in its entirety and renders it possible to free the post mor and fundal attachments as far as the trigone, without an unusual degree of hemorrhage or traumatism. *Sketching the steps as follows:*

**First step: Skin incision.** From one inch above the umbilicus on the left side downwards to two inches above the symphysis in median line.

The breadth of the rectus is divided along the whole length of the skin incision and the peritoneal cavity opened. The patient is then placed

in the extreme Trendelenburg position and the intestines gently deposited in the upper portion of the abdominal cavity. After this the pelvic cavity is thoroughly walled off by gauze rolls.

**Second step: Exposure of the prevesical space.** Lengthen the abdominal incision downwards through skin and fascia and divide the pyramidalis muscle at the symphysis, exposing the prevesical space.

**Third step: Exposure of the hypogastrics (Fig. 1).** The peritoneum and urachus are grasped with a Barrett's intestinal forceps at the lower angle of the peritoneal incision. Upon traction being made upwards, the obliterated hypogastric arteries are brought prominently into view extending laterally as two diverging cords.

**Fourth step: Exposure of the vas deferens (Fig. 2).** The left obliterated hypogastric artery is grasped with a forceps and traction made upwards and to the right. By blunt dissection between the obliterated hypogastric artery and lateral wall of the pelvis, the left vas deferens is recognized and brought into view as it courses along the pelvic wall to the inner side of the obliterated hypogastric artery.

**Fifth step: Exposure of the ureters (Fig. 3).** By gentle traction the left vas deferens is made taut and by means of blunt dissection downwards along its course the pelvic ureter is uncovered as it bends inward above the fascia of the pelvic floor to enter the bladder. The ureter at this point is crossed on its inner side by the vas deferens. A similar exposure is made on the opposite side and the right ureter exposed.

**Sixth step: Final separation of peritoneum from the bladder (Fig. 4).** The urachus is divided close to the bladder and from the two points of lateral dissection the peritoneum is stripped off the fundal surface of the bladder. The denudation extends deep into the rectovesical space and the

beginning of May 1901. Lagoon a man escaped three days ago, since then slight bleeding at intervals, at one bleeding 1 arm al. Temperature rising for last twelve hours, now temperature 38.4 Cels. Pulse 40. On size of a quarter. Fetus expelled four hours later. Placenta without bleeding operation pulled down a foot child, male dead immature puerperium, shortly after labor temperature 38. Pulse 6. Recovery.

No 4 Journal N 350, November 3. 89. Name B. Age 16 VIII para (abortions included) presentation of fetus, I. Vertex. Placenta previa centralis labor last menstruation middle of March. Severe bleeding for several hours. Very anemic. On size the size of dollar. Membranes not ruptured. Internal erosion through the placenta. Child dead and expelled one half hour later. N. bleeding after erosion. Placenta without bleeding operation, internal version child female mature puerperium on the fifth day temperature 38. Pulse then normal.

No 43 Journal N 508, December 2, 89. Name Sch. Age 31 para (abortions included) presentation of fetus II breech presentation. Placenta previa centralis labor last menstruation beginning of March during last week periodical bleeding. Profuse hemorrhage four hours ago. On size of quarter. During expulsion of fetus bleeding several times. Fetus born six hours later. Slight agony after expulsion of placenta operation pulled down. Fetus child female dead length 51 cm. puerperium normal.

No 44 Journal N 666 January 6. 89. Name Sch. Age 7 IV para (abortions included) presentation of fetus I. Transverse position. Placenta previa lateralis labor last menstruation uncertain. Periodical bleeding for several days with slight pains. Severe bleeding for few hours. On size of dollar. N. bleeding after erosion. Fetus pulled 1 hour later. Placenta without bleeding operation combined version child male dead length 45 cm. immature puerperium normal.

No 45 Journal N 694 Name A. Age 33 VI para (abortions included) presentation of fetus I. Vertex. Placenta previa lateral labor last menstruation recent. Severe bleeding for some hours. Anemic. On size of dollar. N. bleeding after version. Fetus expelled until presentation of breech in pelvic outlet few hours later. As for 1 sounds to be heard manual delivery of arms and head. Slight agony in third stage operation combined version. Delivered arms and head. Child female living length 45 cm. puerperium normal.

No 46 Journal N 73. Name F. Age 27 III para (abortions included) presentation of fetus I. Transverse position. Placenta previa total labor

last menstruation August 1891. Slight periodical bleeding during last 14 days. On size of half dollar. After version no bleeding, fetus expelled four hours later. Placenta without bleeding operation, combined version child male living immature puerperium on the third day temperature 38.7. Pulse 30. Fourth day temperature 37.3. Pulse 100. Recovery.

No 47 Journal No 755, February 9. 1891. Name Sch. Age 35 IV para (abortions included) presentation of fetus, I. Vertex. Placenta previa lateralis labor last menstruation June, 1890. Severe bleeding at intervals during last hours. Anemic. On size of one-half dollar. No bleeding after erosion. Fetus expelled six hours later. Placenta without bleeding operation, combined version child female immature (seventh month) puerperium, normal.

No 48 Journal No 758, February 20. 89. Name M. Age 31 para (abortions included) presentation of fetus, I. Vertex. Placenta previa lateral labor last menstruation beginning of June. 89. Periodical hemorrhages during last five hours. 1st severe. Strong pains. On almost fully dilated. Head in pelvic inlet. After rupture of membranes head descended and bleeding stopped. Fetus expelled shortly after. Placenta without bleeding operation membranes child, male living length 45 cm. cu of head 3 cm. puerperium normal.

No 49 Journal No 769 February 4. 89. Name K. Age 29 V para (abortions included) presentation of fetus I. Transverse position. Placenta previa centralis labor last menstruation July 1890. Bleeding February. Sch. ad. 3d. Slight pains slight hemorrhage. On size of one-half dollar. No con red with placenta. No bleeding after erosion no fetal sounds. Fetus expelled one half hour later. After expression of placenta slight tons operation combined erosion, child male dead length 43 cm. puerperium normal.

No 50 Journal N 790 February 29. 89. Name M. Age 34 VIII para (abortions included) presentation of fetus I. Vertex. Placenta previa lateral immature labor last menstruation May 490. On day 40 hemorrhage with slight pains for eight hours hemorrhage at intervals. Temperature 37 C. Pulse 90. Slight anemia. Strong pains for one half hour. On size of dollar. Head in pelvic inlet. N. bleeding after rupture of membranes and head descended quickly. Fetus expelled one hour later. Placenta without bleeding operation, ruptured membranes child male living puerperium, on the third and seventh days temperature 40.3 C. Foul smelling lochia. Intera uterine discharging. Recovery.

# DEPARTMENT OF TECHNIQUE

## AN OPERATIVE TECHNIQUE FOR RADICAL EXTIRPATION OF VESICAL NEOPLASMS

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THE success of any operation upon the bladder for malignant disease will be judged solely by the end-result, and the final criterion must be the percentage of cases which survive the primary operative mortality and remain free from recurrence after the arbitrary time limit.

Statistics demonstrate that resection of the bladder for malignant disease has been so frequently succeeded by recurrence that the usual approach has been inadequate for complete extirpation, or at least in preventing implantation recurrence.

With these ideas in mind it has been our aim to elaborate a technique for the exposure of the bladder and its contained neoplasm that would allow of an extensive resection of the bladder wall adjacent to the growth as well as an orderly plastic repair of the ureters if these should be found involved.

The growth is removed *en masse* with a wide encircling margin of healthy tissue and since it is a matter of record that a functioning bladder has been regenerated where only the trigone has remained after an extensive resection it is apparent that it is only necessary to conserve the three natural orifices of the bladder the ureteral orifices and the internal meatus. Considering this anatomic trinity the technique about to be outlined exposes the bladder in its entirety and renders it possible to free the posterior and fundal attachments as far as the trigone without an unusual degree of hemorrhage or traumatism. *Seriatim* the steps are as follows:

**First step Skin incision.** From one inch above the umbilicus on the left side downwards to two inches above the symphysis in median line.

The sheath of the rectus is divided along the whole length of the skin incision and the peritoneal cavity opened. The patient is then placed

in the extreme Trendelenburg position and the intestines gently deposited in the upper portion of the abdominal cavity. After this the pelvic cavity is thoroughly walled off by gauze rolls.

**Second step Exposure of the prevesical space.** Lengthen the abdominal incision downwards through skin and fascia and divide the pyramidalis muscle at the symphysis, exposing the prevesical space.

**Third step Exposure of the hypogastrics (Fig 1).** The peritoneum and urachus are grasped with a Barrett's intestinal forceps at the lower angle of the peritoneal incision. Upon traction being made upwards, the obliterated hypogastric arteries are brought prominently into view extending laterally as two diverging cords.

**Fourth step Exposure of the vas deferens (Fig 2).** The left obliterated hypogastric artery is grasped with a forceps and traction made upwards and to the right. By blunt dissection between the obliterated hypogastric artery and lateral wall of the pelvis, the left vas deferens is recognized and brought into view as it courses along the pelvic wall to the inner side of the obliterated hypogastric artery.

**Fifth step Exposure of the ureters (Fig 3).** By gentle traction the left vas deferens is made taut and by means of blunt dissection downwards along its course the pelvic ureter is uncovered as it bends upward above the fascia of the pelvic floor to enter the bladder. The ureter at this point is crossed on its inner side by the vas deferens. A similar exposure is made on the opposite side and the right ureter exposed.

**Sixth step Final separation of peritoneum from the bladder (Fig 4).** The urachus is divided close to the bladder and from the two points of lateral dissection the peritoneum is stripped off the fundal surface of the bladder. The denudation extends deep into the rectovesical space and the

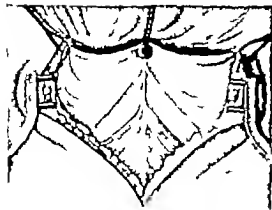


Fig. 2 Exposure of perivesical space. Urachus and deviating obliterated hypogastric arteries held taut by intestinal forceps.

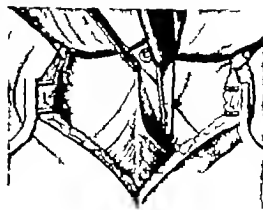


Fig. 3 Exposure of the left vas deferens by blunt dissection along the course of left obliterated hypogastric artery.

peritoneal cul-de-sac of Douglas is pushed upwards and backwards. At this point traction on the bladder downwards towards the symphysis exposes the superior poles of the seminal vesicles. The result of the completed denudation is that the whole fundus of the bladder and the upper portion of the posterior surface of the trigone is exposed; the ureters are constantly in sight and the anterior or pubovesical attachments of the bladder have been left undisturbed. No hemorrhage of any moment has been encountered and the venous ooze has been easily controlled by hot wet pads.

*Seventh step. Protection of the peritoneal cavity.* The denuded lamella of the peritoneum is care-

fully attached to the upper end of the abdominal incision so that all subsequent procedures are extraperitoneal.

*Eighth step. Exposure of bladder neoplasm.* (Figs. 5, 6 and 7.) The bladder is grasped high up on the posterior surface and an incision is made in the longitudinal direction, about one inch in length. Through this opening an inspection of the bladder is made and the topography of the tumor determined. The incision is extended in any direction that may be necessary for proper operative exposure. Since in the majority of instances, the tumor will be found to occupy either the summit, neck, or trigone of the bladder

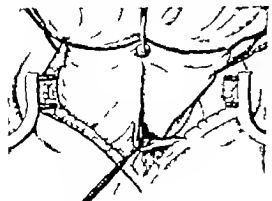


Fig. 4 Exposure of left vas deferens by blunt dissection along the course of left vas deferens.

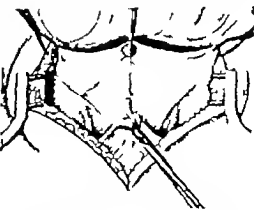


Fig. 5 The final separation of peritoneum from the bladder exposing both ureters, vas deferens and upper pole of trigone.

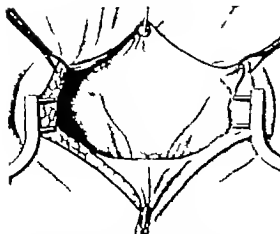


Fig. 5 The bladder pulled downwards towards the symphysis and the primary incision in the bladder for inspection of the neoplasm

an incision downward in the posterior median line which splits the organ in half will be the usual incision of election.

*Ninth step. Extirpation of neoplasm* (Fig. 8) The neoplasm is excised *en masse* together with a wide margin of healthy uninvaded tissue comprising the entire thickness of the bladder wall. The exposure of the ureter which has already been made now becomes of prime importance. If the ureter is affected it is divided between ligatures above the growth and the distal portion is removed with the tumor. The proximal portion is allowed to remain undisturbed until partial closure of the bladder defect is accomplished.

*Tenth step. Closure of bladder defect with manipulation of ureter* (Fig. 9). The hiatus of the

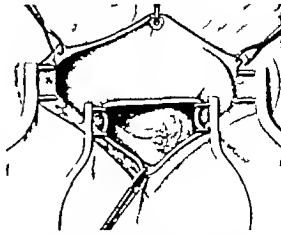


Fig. 6 The bladder incision enlarged downwards and towards the ureter for more thorough inspection

bladder wall after incision of the tumor is partially repaired as illustrated in Fig. 9, the method of closure being similar to the Connell intestinal suture with No. 2 chromic catgut. A stab wound is made through the bladder wall at a point approximating the normal ureteral opening and the proximal portion of the divided ureter drawn through this opening by a thin dressing forceps.

*Eleventh step. Anchoring the ureter to the bladder mucosa* (Fig. 10). The ureter is brought through the stab wound and anchored to the bladder wall. About one-half to three-fourths of an inch of the ureter is allowed to protrude into the bladder. Two flaps are made by bissection of the ureteral stump and the flaps turned back and

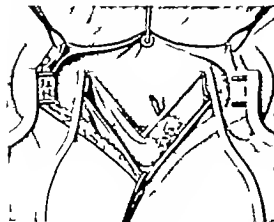


Fig. 7 Bisection of posterior bladder wall previous to extirpation of neoplasm

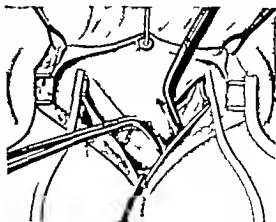


Fig. 8 The neoplasm and affected ureter excised *en masse* with a wide encircling margin of healthy tissue. Hemostasis secured by right angle forceps. Temporary ligature around proximal ureter.

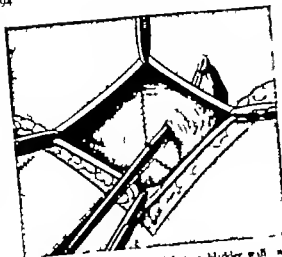


Fig. 9. Partial incision of defect in bladder wall and drainage tube for ureteral obstruction. Drainage tube is placed in the bladder wall.

anchored in situ. The remaining defect in the bladder is now sutured as above and drainage of the bladder is insured by means of a stab button-hole incision anterior to the line of incision and at a point which will correspond to the highest point of the bladder when the operation is completed. Through this aperture a No. 36 F soft rubber catheter is drawn and sutured in situ. A drainage tube is inserted in this manner insures against leakage along the tube into the prevesical space, a point previously emphasized by the senior author (Squier, Fig. 1).

**Twelfth step.** Closure of abdominal wound. The final step is the reposition of the peritoneum over the vesical suture line and an accurate closure of the peritoneum. If the peritoneum is in adhesion with the growth the incised portion is resected with the growth and the peritoneal flaps closed after the usual fashion, particular care being taken to prevent a peritoneal suture line. A superimposed upon a bladder suture line. A cigarette drain is inserted into each lateral space leading down to ureter and the abdomen closed with figure of eight silk worm sutures. I add with figure of eight catheter is inserted (Fig. 2).

Among the advantages of this method of technique may be mentioned:

By primary denudation of the peritoneum free access to the posterior surface of the bladder and trigone is obtained.

The removal of the tumor by any of the methods

described in this paper

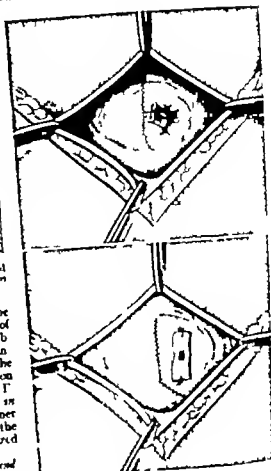


Fig. 10. Final closure of abdominal wound.

Fig. 11. Final closure of abdominal wound.

1. The button-hole drainage of the bladder is a distinct advantage. It is in accordance with the prevesical space and is distinct and a tube and suture line is not on the surface.

2. The reposition of the peritoneum insures the bladder and insures primary union.

3. The ureter is repositioned in sight and the exposure allows wide latitude of operative procedures.

Fifteen patients suffering from various degrees of vesical carcinoma have been operated in this manner.

Three patients with vesical carcinoma have been operated in this manner. In the first case the bladder was removed and the peritoneal cavity was closed by the use of the button-hole drainage. In the second case the bladder was removed and the peritoneal cavity was closed by the use of the button-hole drainage. In the third case the bladder was removed and the peritoneal cavity was closed by the use of the button-hole drainage.

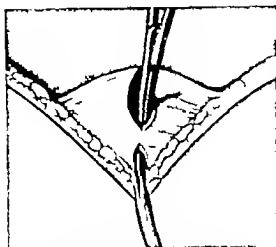


Fig. 1. A counter-opening for drainage of bladder

technique with no operative mortality. The amount of the bladder wall removed has been extensive in every instance.

In every operation we have been impressed with the comparative ease with which each step of the technique could be carried out, together with the subsequent restoration of bladder function. While the growth has been so extensive in these patients as to almost preclude the probability of cure the patients have been relieved of many of the distressing symptoms with a return to a condition of comparatively good health.

The field seems a most fertile one for surgical investigation because vesical carcinoma in many cases is a slow growing neoplasm and remains localized to the bladder for a long period.

We are confident that with early diagnosis and

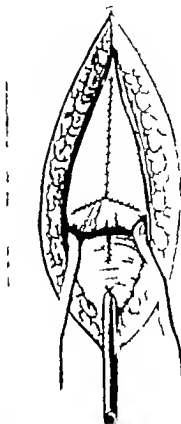


Fig. 2. Accurate closure of peritoneal cavity showing the 1.5 cm. drain and separate stab wound for drainage of bladder

a radical extirpation along the lines indicated, surgery of vesical neoplasms will give an increasing percentage of cures.

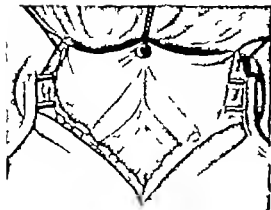


Fig. 2 Exposure of prevesical space. Ureters and descending obliterated hypogastric arteries held taut by intestinal forceps.



Fig. 3 Exposure of the left vas deferens by blunt dissection along the course of left obliterated hypogastric artery.

peritoneal cul-de-sac of Douglas is pushed upwards and backwards. At this point traction on the bladder downwards towards the symphysis exposes the superior poles of the seminal vesicles. The result of the complete dissection is that the whole fundus of the bladder and the upper portion of the posterior surface of the trigone is exposed; the ureters are constantly in sight and the anterior or pubovesical attachments of the bladder have been left undisturbed. No hemorrhage of any moment has been encountered and the encephalic nose has been well controlled by hot wet pack.

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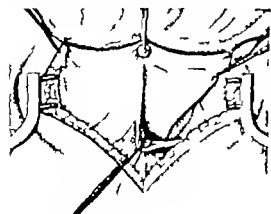


Fig. 4 Exposure of left ureter by blunt dissection along the course of left vas deferens.

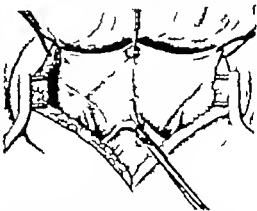


Fig. 5 The first separation of peritoneum from the bladder; exposure both ureters, vas deferens and upper pole of trigone.

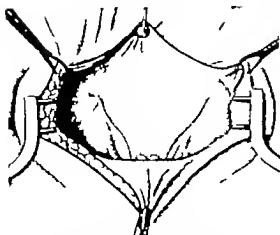


Fig. 5 The bladder pulled downwards towards the symphysis and the primary incision in the bladder for inspection of the neoplasm

an incision downward in the posterior median line which splits the organ in half will be the usual incision of election.

*Ninth step: Extirpation of neoplasm* (Fig. 8). The neoplasm is excised *en masse*, together with a wide margin of healthy uninvaded tissue comprising the entire thickness of the bladder wall. The exposure of the ureter which has already been made now becomes of prime importance. If the ureter is affected it is divided between ligatures above the growth and the distal portion is removed with the tumor. The proximal portion is allowed to remain undisturbed until partial closure of the bladder defect is accomplished.

*Tenth step: Closure of bladder defect with implantation of ureter* (Fig. 9). The hiatus of the

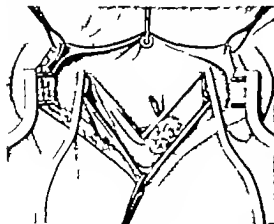


Fig. 7 Bisection of posterior bladder wall previous to extirpation of neoplasm

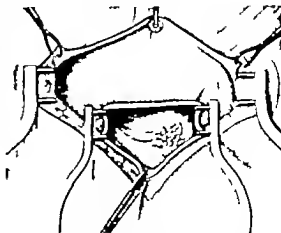


Fig. 6 The bladder incision enlarged downwards towards the ureteric orifice for more thorough inspection

bladder wall after incision of the tumor is partially repaired as illustrated in Fig. 9, the method of closure being similar to the Connell intestinal suture with No. 3 chromic catgut. A stab wound is made through the bladder wall at a point approximating the normal ureteral opening and the proximal portion of the divided ureter drawn through this opening by a thin dressing forceps.

*Eleventh step: Anchoring the ureter to the bladder muscle* (Fig. 10). The ureter is brought through the stab-wound and anchored to the bladder wall. About one half to three fourths of an inch of the ureter is allowed to protrude into the bladder. Two flaps are made by bissection of the ureteral stump and the flaps turned back and

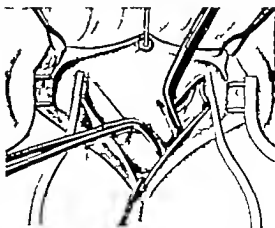


Fig. 8 The neoplasm and affected ureter excised *en masse* with wide encircling margin of healthy tissue. Instruments shown by right angle tissue forceps: temporary ligature round proximal ureter.

## REMARKS ON THE SURGERY OF THE ILEOCÆCAL COIL

By FRANCIS REDER, M. D. SAN LOUIS  
Visiting Surgeon, Saint Louis City Hospital

WITHOUT dilating upon the bacterial toxemia as a direct cause of peritonitis and death in resection of the ileocecal coil, I desire to dwell upon the operative measures that indirectly seem to harbor a causal factor responsible for so high a mortality.

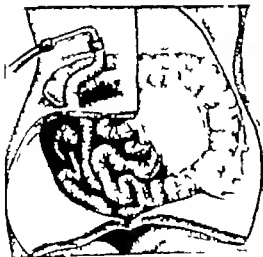
The death rate of ileocecal resections for malignant or tuberculous growths coming within the scope of operative mortality has been higher than resections for similar conditions upon other portions of the intestinal tract.

In asking why so high a death rate should attend an ileocecal resection, I have formulated, as near as my experience has permitted me to judge, a ratio representing the cause of death as one third attributable to the general condition of the patient, while the remaining two-thirds would fall upon the operative measure employed.

The most important feature for successful surgery of the intestinal tract is an early diagnosis. I know many instances has an early diagnosis been made of tumor lesion in the ileocecal region before the growth was sufficiently advanced to be palpable? I think rightly appears to me that such a diagnosis has been the most tardy of any. And why? Because the symptoms

picture, agree in its variations, does not presage the presence of so serious a trouble. It rather invites a diagnosis of intestinal indigestion or chronic appendicitis. The condition is often permitted to go on for weeks and months without even arousing any suspicion on the part of the attending physician. It is usually dissatisfaction on the part of the patient that eventually causes a new light to be shed upon his condition or, if sufficient time has elapsed, a mass in the right iliac region having become palpable may give evidence of the nature of the trouble. During the early stage of the disease such patients are seldom well enough to seek their beds. In fact they attend to some of their work. The bowel disturbances do not seem to cause much discomfort and the appetite, although impaired, does not disappear entirely. These patients when they reach the surgeon are suffering from low grade toxemia and are often profoundly anemic. They are asthenic and in general present an organism of a low resisting power.

To propose an operative measure for the relief of such patient inolves a problem of no mean import—that of adequately judging the physical forces of the patient. It is a serious matter to subject a patient with a chronic lesion of the bowel, and with a wake of toxic symptoms, to an operation fraught with so much shock as a resection. If it could be judged with some certainty that the organism, impaired by disease would recover sufficiently early from the operative measure offered to successfully cope with the insult in view of the colonic flora, the outlook for an operative recovery by the method known as the ideal would be very encouraging.



Intestinal anastomosis ileocolostomy with suture showing the ileal end. The ileocecal coil has been resected.



Modified Paul tube. Introduced through anal vest into large bowel via the anastomotic opening, colon tube can be readily passed and the large bowel for purposes of irrigation, etc.

Read before the Southern Surgical and Gynecological Association, Atlanta, December, 1920.

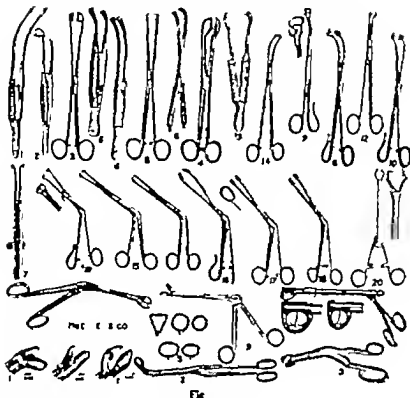
This, however cannot be satisfactorily done and a patient who was able to walk into the operating room, whose anesthesia had been good, and whose condition after the ileocolic coil had been resected was apparently so encouraging that the surgeon without any hesitation completed the operation by making a lateral anastomosis. The ideal method may in such instances prove a great disappointment to the surgeon.

To say that the interpretation of an operative recovery of a patient subjected to the "ideal method" of resection of the ileocolic coil is speculative, is open for criticism. It must be admitted however that the patient so operated upon has not been accorded all the factors of safety in connection with this operation.

The great danger following a successful resection of the ileocolic coil with immediate restitution of the canal lies in the secondary changes which have taken place in the intestinal walls induced by the disease for which the operation was undertaken. The complete atony of the bowel so often present activates various infective processes generated by the pent-up bacteria. Whenever the virulent contents of the bowel become stagnant at the site of suture, the suture frequently yields and a peritonitis, usually incompatible with life results. One of my cases that bore the greatest aspect developed a fecal fistula on the fifth day after operation and recovered. This happy termination occurred after a patient had died by the "ideal method" on the ninth day following the operation. It rather demonstrated to me the fact that a vent became almost a necessary adjunct to this operative procedure.

The next ileocolic resection presented more than the usual difficulties. The condition seemed most favorable for the establishing of an artificial anus. This operative procedure was carried out successfully and the patient made a satisfactory recovery. An endeavor to reestablish the continuity of the bowel two months later caused the death of this patient from peritonitis. Having had two recoveries with the "ideal" operative measure that proved in no way more severe than a simple appendectomy I at no time underestimated the difficulties of the choice of an operation for the resection of the ileocolic coil. The death of the patient from peritonitis, the result of an operative procedure for the correction of an artificial anus, although most deplorable, rather encouraged me in this operative measure and in the last two cases I successfully employed a technique that carried with itself the feature of an artificial anus, but in a

modified form. The advantage of this technique is a vent that will not require risky operative measures for its successful closure. The technique is as follows: Incision through the outer edge of right rectus muscle. Ablation of the tumor and the removal of the mesenteric glands. The division of the ascending colon and the ileum is an important feature. Inasmuch as cecal growths usually embody considerable of the ascending colon, the hepatic flexure may not be far distant. It is of some advantage to make the section of the colon at or beyond the hepatic flexure. The division of the ileum should be such as to give the bowel the necessary latitude to be brought without tension in contact with the colon near the point of resection. At least six inches of the ileum should be sacrificed. The end of the colon is closed with suture in the accepted manner. The end of the ileum is closed temporarily with a basting stitch so as to avoid spilling any of its infective contents while the operation is in progress. A lateral anastomosis with an opening not less than three inches is performed. With a suture can entirely placed through the serosa of the bowel, the end of the resected colon is secured to the abdominal wall as far laterally as can be done to relieve tension upon the line of anastomosis and possibly anticipate any future displacement of the gut. After the anastomosis is completed, the free end of the ileum is drawn out of the abdomen, is sutured to the parietal peritoneum of the wound into its uppermost corner away from any viscus that may be liable to get caught at the point of fixation and the abdominal wound is closed. If a more advantageous implantation of the ileal end can be made through a small secondary abdominal incision, this should be done and the primary incision closed completely. The basting suture closing the portion of ileum brought out of the abdominal cavity is removed and a glass drainage tube introduced, thus establishing the desirable vent. This vent will answer the purpose not only in serving as a factor of safety in permitting the immediate escape of the contaminated bowel contents and flatus, but it will also answer the purpose in giving the necessary access for the introduction of saline solutions and irrigations so essential in a condition of bowel atony. The colon, if necessary and it frequently is necessary, can be readily irrigated by introducing a modified Paul's tube into the lumen of the ileum down to the anastomotic opening leading into the colon. Through this Paul's tube a colon tube can be readily introduced into the large bowel for irrigation.



Fig

## TONSIL FORCEPS

1. Frazier	6. Robertson's	11. Andrew Ficker's	16. White	21. Koettlicher's
2. Boardley's	7. Petros'	12. Hallenger's	17. Tyching	22. Travers's
3. Legall's	8. Moscare	13. Deen's	18. Richard Monrook	23. Hard's
4. Pychess	9. Cassberry	14. Collier's	19. Brown's	

## TONSIL POINCES

1. Miles'	2. Rhode's	3. Rault's	4. Robert Mueller's	5. Hartman's
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still had a very disagreeable difficulty with the operation, and that was the apparent sudden hemorrhage, which is not a hemorrhage at all but a sudden liberation of all the blood-vessels that are intimately connected with the tonsil.

The addition of a snare to the Sluder instrument was recommended for the purpose of controlling the bleeding, and though we found it cumbersome still the bleeding was considerably less than by the Sluder-Balenger instrument. This led us to the development of the instrument which we called the tonsillectome (Fig 6) which is nothing more than a snare supplied with a ring that has a groove for the hiding of the wire loop, adopting the Sluder technique in the main with the exception of ignoring the hump on the lower jaw and lifting the tonsil upward into the supratonsillar fossa. This operation and instru-

ment have been described elsewhere<sup>1</sup> and we have been employing it ever since with excellent results and with practically no changes. There have been a few important and interesting observations made, which we will mention at this time and also briefly describe the procedure in connection with the adenoid operation, since the tonsillectomy and adenectomy are usually performed at the same time.

We have adopted this rule: Whenever we could Sniderize a tonsil (that is, were able to push it through the ring without undue force) we would employ the tonsillectome. This is possible in more than 85 per cent of the cases. If, however this did not occur we would resort to the sharp dissection rather than succeed and traumatize the tissues.

<sup>1</sup> J. Am. M. Ass., 1922, vol. 80, p. 200.

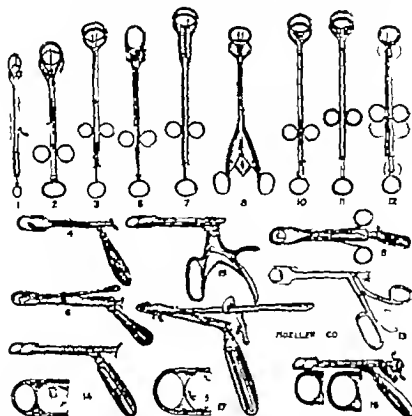


Fig 3

## TONSILLOTOMIES AND GULLOTTOMIES

- |               |                 |                |                       |                               |
|---------------|-----------------|----------------|-----------------------|-------------------------------|
| 1 Fahrenstock | 4 McKenzie      | 8 Warder's     | Ernold's              | 5 Sluder Ballenger Gullottome |
| 2 Fahrenstock | 5 Bellamy       | 9 Haralton     | 6 Ballenger Ecraseur  | 6 Sluder Snare Gullottome     |
| 3 Improved    | 6 Green's       | 10 Cassberry's | 7 Sluder's Gullottome | 7 Sluder with Mechanic's Dog  |
| 3 McIlhenny's | 7 Lary's case's | 11 Scapler     |                       |                               |

We have formulated some of the reasons why some tonsils are difficult of Sluderization, and consequently are not adapted to this method of operating. One of the most frequent causes is previous peritonsillar abscess with subsequent marked adhesions, especially if the case was locked before the abscess became fluctuating, or if the incisions were made in regions where the abscess was not pointing. Second, in cases in which there had been previous attempts at tonsil dissection (not tonsillotomy). Third, under local anesthesia or incomplete relaxation in general anesthesia. Fourth, where there is a very long and slender portion of the tonsil below the level of the base of the tongue. Lastly in the rare cases of markedly short palatoglossus muscles, occurring twice thus far in our experience.

We have further found that the small size instrument that was first devised for this opera-

tion, considered by those who had no experience with it as too small was too large in some of the small submerged tonsils, especially in small children, and we were compelled to employ a much smaller ring. One must remember that the proper eversion of the tonsil from its capsule depends on the purchase of its cryptic face on the entire circumference of the ring. This will cause the tonsil to come through with a sort of thud.

The question of bleeding is always important in all tonsil operations, and in this procedure we have found that the average bleeding is less than by any other method. There are, however, cases in which the bleeding is quite brisk. We believe that this primary bleeding depends on the pathological condition of the throat at the time of the operation. (a) If tonsillotomy is done too soon after an acute attack, the bleeding

A disadvantage of this surgical measure is the existence of an artificial anus. Inasmuch as only the ileum is brought out of the abdomen, the artificial anus is one of much lesser magnitude and usually closes within several weeks, without the aid of a severe operative measure. Its advantage of being a factor of safety should overshadow any sense of discomfort it may cause.

#### Ileocecal resections

##### Deaths—

- 3 Ideal method.
- 1 Artificial anus.

##### Recoveries—

- 2 Ideal method. (One died post festum 5 days after operation.)
- 1 Artificial anus.
- 2 Writer's method.

## THE EVOLUTION OF THE TONSIL AND ADENOID OPERATION AND A DESCRIPTION OF THE WRITER'S METHOD OF PROCEDURE

By JOSEPH C. BLACK, M. D., CHICAGO

THE earliest operative procedure for removal of the faucial tonsil dates back to the time of Celsus, who advised finger emucation, but subsequent methods consisted principally in removal of portions of the tonsils—tonsillotomy. Without going into a detailed description of these antiquated methods, to which however we wish to acknowledge our indebtedness in developing better methods, we will briefly mention the most important modifications by illustrating the instruments (Figs. 1 to 5).

Intentional tonsillectomy, so far as the literature shows, was performed first by E. Pyechon of Chicago by the electrocautery dissection, and by the cold method using the knife or snare or both, by William Ballenger of Chicago. I say intentional tonsillectomy because almost every body removes tonsils with capsules intact by tonsillotomes or snares accidentally in those cases that have very loose attachment to their surrounding structures.

At about the same time a large number of laryngologists in America took up the subject of tonsillectomy and the literature began to beam with modifications of operative procedure for the complete emucation of the tonsil. Finger dissections, without preliminary dissection of the pillars, became quite popular in the East, advocated by Mithofer and Richardson, and about that time appeared the present writer's article on tonsillectomy by sharp instruments, and immediate hemostasis by angiotribe while dissecting. Freer's systematic technique of dissection by sharp instruments appeared soon after. The dissection by means of a dull spoon or director by McWhinney came

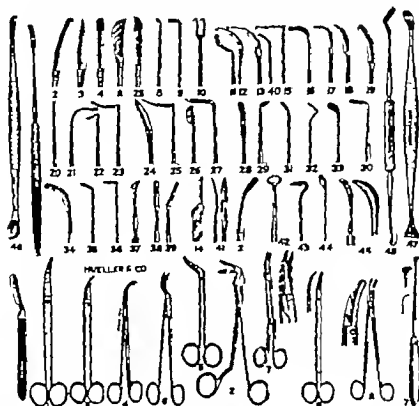
into prominence, especially in New York City and was successfully practiced all over the country. For several years these various modifications (and many more could be added) were practiced by most of the laryngologists and by many general men.

Following these operative procedures, the observations were made and published by many that considerable scar formation resulted from final coagulation between the anterior and posterior pillars, and that the anterior pillars particularly were sometimes so augmented to the markedly thickened posterior pillar as to be entirely lost in their outline. To this condition Huxley-Maham and Stuck called especial attention, although every operator observed it. Since it caused very little or no difficulty there was little attention paid to it, especially since the local and systemic results from the complete removal of the tonsils were so satisfactory.

When Greenfield Slader presented the subject of intentionally removing the tonsils without preliminary dissection of the pillars, etc., by the aid of one instrument and the employment of a constant antiseptic point on the lower jaw—the eminently alveolar or hump—corresponding to the last molar tooth, an entirely new departure from the accepted technique took place.

Most of the laryngologists discredited, at first, the possibility of such a procedure, knowing how difficult it was at times to dissect a tonsil with the aid of several instruments. Not informed as to the possibility of the operation, we were willing to first see him.

terrible  
tender  
sore  
the



Fig

## TONSIL IVES DIRECTORS ETC

Bacon	14	Ballenger's	30	Ballenger's	38	Dean Straight
Hobbs	5	Swan vs e-edged	30	Food's Retractor	39	Dean Angular
34 Greene	6	Kulhan's	8	Seler's	40	Douglas
1 Robertson's	7	Tyding	29	Freer's No	4	Good's
6 Beck's No	8	Causefield's	30	Freer's N	4	Barker's Tenacula
7 Parrot	9	Greene R & L	3	Dar' N	43	Dickinson Retractor
8 Abraham's Corlett	20	Swan plain	3	Stevensons	44	Ballenger's Corlett
9 Boettcher's Hook	21	Schmed's Retractor	33	Carney's	45	Greene Retractor
Plana Hook		Kyle's	34	Greene	46	M Whimpe Hard Retractor
Hager's		Leland's Original	35	Dar' N	47	Hard Retractor and Re-
Robertson Allport's	24	Pyrodon	36	Du' N	45	tractor
3 Allport's vs e-edged	3	Leland's Improved	3	Beck's		Carpenter's Retractor

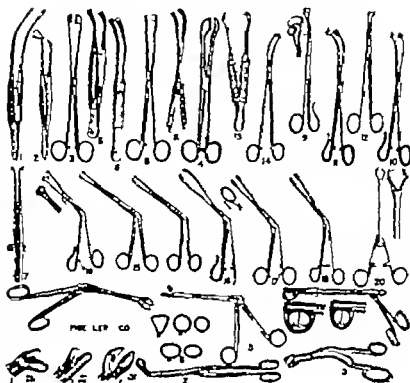
## TONSIL SCISSORS

1. Fenger's	2. Robertson's	3. Price's	4. Griffin's	5. Farrell's	6. Windle's	7. Boettcher's	8. Metzenbaum
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factory. Not that it was impossible but it required considerable force in the manipulation, using the original dull-bladed instrument recommended by Sluder particularly when adhering to the anatomical principle of bringing the tonsil over the hump of the lower jaw. We also found that very frequently the blade would not cut through, so that a knife had to be employed in addition to cut it loose at the upper and lower extremity. While experimenting with this operation we found that we could ignore the hump on the lower jaw since the latter when the mouth

was opened by a mouth gag, was much too low for the tonsil to be dragged over in a good many instances, especially when we had a tonsil with a high earlobe.

Consequently we adopted the uniform technique of lifting the tonsil forward and upward by means of the instrument, and then with the finger pushing or feeding the tonsil through the ring cutting it off by means of a sharp blade. When Ballenger modified the Sluder instrument, we adopted that, because the operation was easier to perform by means of that instrument. We



Fig

## TONSIL FORCEPS

1	Falconer	6	Robertson's	11	Andrew Pearce'	16	White	21	Bottcher
2	Beardley's	7	Peters'	12	Balinger'	17	Tyding's	22	Tyner's
3	Ingall's	8	Mossure's	13	Deau's	18	Richard Morawick's	23	Hurd's
4	Pynchon's	9	Cassellberry	14	Colliver	19	Brown Alal	24	

## TONSIL PLUCKERS

1	Alfies'	6	Rhode	11	Rauli's	16	Robert Mueller's	21	Hartman's
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still had a very disagreeable difficulty with the operation, and that was the apparent sudden hæmorrhage, which is not a hæmorrhage at all, but a sudden liberation of all the blood-vessels that are intimately connected with the tonsil.

The addition of a snare to the Sluder instrument was recommended for the purpose of controlling the bleeding, and though we found it cumbersome, still the bleeding was considerably less than by the Sluder-Balinger instrument. This led us to the development of the instrument which we called the tonsillectome (Fig 6) which is nothing more than a snare supplied with a ring that has a groove for the hiding of the wire loop, adopting the Sluder technique in the same with the exception of ignoring the hump on the lower jaw and lifting the tonsil upward into the supraglottic fossa. This operation and instru-

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<sup>1</sup> J. Am. M. Ass. Sept. 1910, vol. 10.

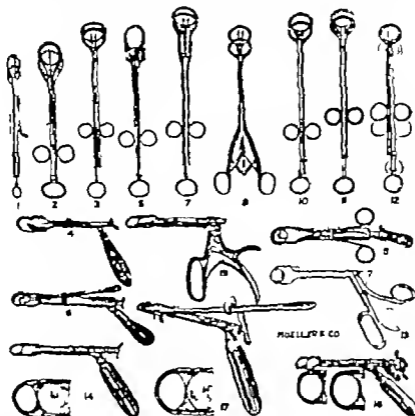


Fig. 3

## TONSILLECTOMY TO GULLOTOMY

Fallesenstock	4	McKenzie	8	Winkler's	13	Ernold's	5	Slader Ballenger Gullotine
Fallesenstock's Improved	3	Billing's	9	Marmion's	12	Ballenger Ecraseur	6	Slader Bauer Gullotine
Mathieu's	7	Cowan's	10	Cassellberry Simplex	4	Slader's Gullotine	7	Slader with McEwen's Dog

We have formulated some of the reasons why some tonsils are difficult of Sladerization and consequently are not adapted to this method of operating. One of the most frequent causes is previous peritonsillar abscess with subsequent marked adhesions, especially if the case was located before the abscess became fluctuating, or if the incisions were made in regions where the abscess was not pointing. Second, in cases in which there had been previous attempts at tonsil dissection (not tonsillectomy). Third, under local anesthesia or incomplete relaxation in general anesthesia. Fourth where there is a very long and slender portion of the tonsil below the level of the base of the tongue. Lastly in the rare cases of markedly short palatoglossus muscles, occurring twice thus far in our experience.

We have further found that the small size instrument that was first devised for this opera-

tion, considered by those who had no experience with it as too small, was too large in some of the small submerged tonsils, especially in small children and we were compelled to employ a much smaller ring. One must remember that the proper eversion of the tonsil from its capsule depends on the purchase of its cryptic face on the entire circumference of the ring. This will cause the tonsil to come through with a sort of thrust.

The question of bleeding is always important in all tonsil operations, and in this procedure we have found that the average bleeding is less than by any other method. There are, however, cases in which the bleeding is quite brisk. We believe that this primary bleeding depends on the pathological condition of the throat at the time of the operation. ( ) If tonsillectomy is done too soon after an acute attack, the bleeding

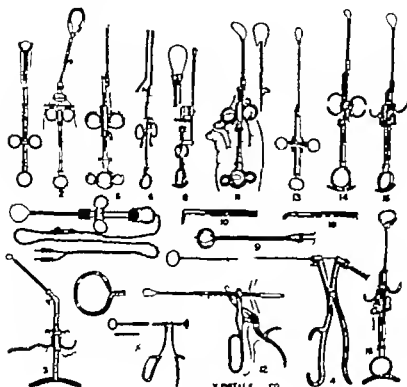


Fig. 4

TONSIL PLAINES						
Pector's	5	Farlow's	9	Knight's Electric	3	Brannan's
Inglis's	6	Morgan's		Pynchon Tonsil Electrode	14	Marion's
3 Bosworth's	7	Grady's Electric		Farlow's Boettcher	5	Farlow's Boettcher
4 Peters'	8	Pynchon's		Tyding's	6	Beck's Mueller Tonsillectors

will be more profuse and (b) the anatomical distribution and the size of the vessels are also not the same in every case, and much depends on this condition as to how much bleeding occurs.

The point of reaction of the surrounding tissues of the tonsil is of great importance, since the degree of secondary contraction will be proportionate to the amount of inflammatory reaction. In this operation there is less reaction than in the ordinary sharp or blunt dissection, but more than the sharp Sluder operation.

As to the point of destruction of vital structures, as muscles and mucous membrane of the pillars, we find that in this operation there is absolutely no mucous membrane or muscle inolved, and one will find the capsule of the tonsil smoother than in any other method of tonsillectomy.

The very important point in this, as in any

other method of tonsillectomy is the necessity of experience before judgment can be passed upon the value of this procedure. The first few cases will perhaps be failures, especially so far as the lower pole of the tonsil is concerned, and especially if one will insist upon operating tonsils which do not Sludize easily and should really be dissected.

The various criticisms against this as well as the Sluder procedure are usually based upon inexperience, and purely on theoretical grounds. As said in the beginning, it does not seem possible to one who has been doing tonsillectomy only by the dissection method. The criticism from Vienna, by Tausser and Weil, is particularly unjust to the method, and we are quite sure that these opinions will not influence those that will try the Sluder operation or any of its modifications.

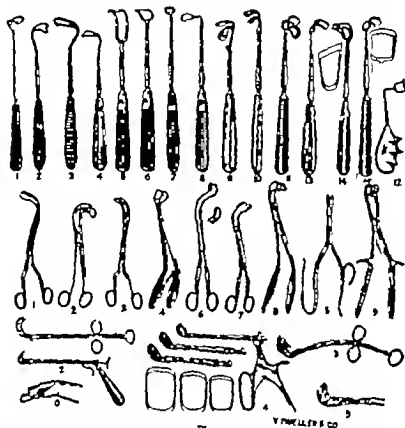


Fig 5

V. J. PELLER'S CO

ADENOID CURETTES									
1. Gottstein's	4. Schmidt's	7. Mason's	10. Delstauche Improved	13. Barnhill's					
2. Menger's	5. Krutem	8. Krutem	11. St. Clair Thompson's	14. Todd					
3. Denley's	6. Beckmann's	9. Delstauche's	12. Fine's	15. Beck's					
ADENOID FORCEPS									
1. Löwenberg's	4. Miesner's	5. Tognoli Frere's	7. Fraser's	9. McCashiff's					
2. Lissak's	4. Gracie	6. Quailen	7. Benzinger's	10. Memon's Curette					
ADENOTOMES									
Schuster's	Gracie's	3. La Forge's	4. La Forge's Universal	5. Stevenson's					

Among the accessories that we employ in the tonsil operation which are important to success is the anæsthetic. We employ ether exclusively after having tried gas-oxygen for some time because we find that the latter does not completely relax the pharyngeal muscles, which is necessary to the tonsillectomy and even more so to the adenectomy as will be shown later.

To induce anæsthesia we employ what Rovsing has recommended — the rebreathing of ether with a somnoform apparatus. About two ounces of ether is placed in the rubber bag and, after applying the mask firmly over the face, and about the nose and mouth, the air

valve is opened and the patient breathes air and a small amount of ether. When the air valve is partly closed, the ether vapor is increased, until finally the valve is entirely closed and the patient breathes pure ether. This he continues to do, when finally a quantity of  $\text{CO}_2$  will form within the bag. This is called the rebreathing of ether since the patient exhales some of the excess. The  $\text{CO}_2$  is considered of benefit to a certain degree in ether anæsthesia, and whenever it accumulates to an excess the patient becomes cyanotic. The air valve is then opened and some air allowed to be breathed in. This method of induced anæsthesia we have found to be the

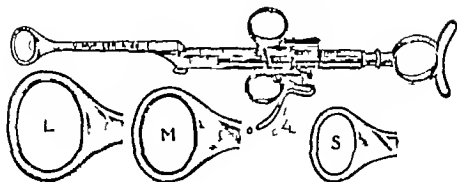


Fig. 6

Fig. 6 Instrument developed by the author which has been named the sommellectone. It is simply made up of a ring that has been adapted for holding the wire loop of its use the Slader technique has been adopted with the exception of ignoring the hump on the lower jaw and lifting the nasal upper dental the supratentorial foramen.

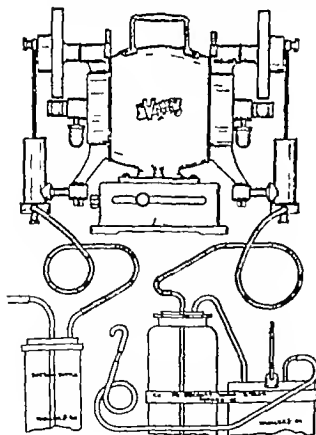


Fig. 7

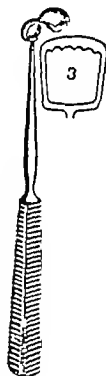


Fig. 8

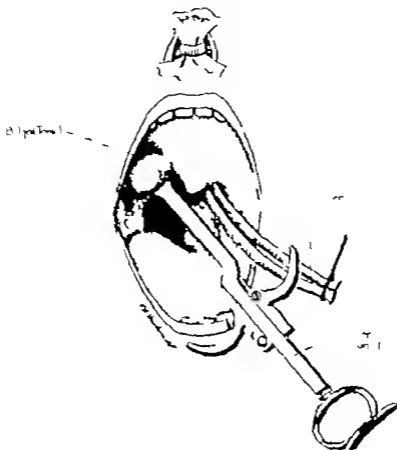


Fig 6

least irritating and most satisfactory although it requires a little longer than the pouring or drop method. The induced anesthesia is then followed with the forced vapor method.

For this purpose we use an apparatus (Fig 7) consisting of a Victor motor to which are attached two separate pumps, one to the suction apparatus the other to the ether bottle. Thus vaporized ether forced through a small tank (Cain & Dermot) which contains wound within it about twenty feet of tubing surrounded by thermolite. This tank is hermetically sealed and when placed in hot water for about ten minutes heat up the thermolite, the latter holding the heat for some time. The ether which is passing through the heated tubes within this tank thus has its chill taken off and is easier for respiration, absorption and less irritating to the mucous membrane of the respiratory tract. From this tank comes the ether supply

tube and its terminal mouthpiece. This latter acts also as a cheek retractor permitting better inspection. There is also present another bottle for the purpose of suction of blood and mucus. From the suction pump goes a stiff rubber tubing to the suction bottle and from the latter another rubber tubing with a metal tip, to be introduced into the throat etc whenever indicated. The suction is one of the greatest aids in the operation of tonsillectomy and adenectomy.

Atropine before operation is a distinct aid, but we have had the reverse experience in several cases of very young children (that is, near the three year age) who did very poorly with the anesthetic when they received tropine even as little as 100 gr. The symptoms were that of slow breathing and very deep anesthesia. We therefore never employ it in these cases, and it is less necessary since suction is employed.

The general preparation of a patient for a

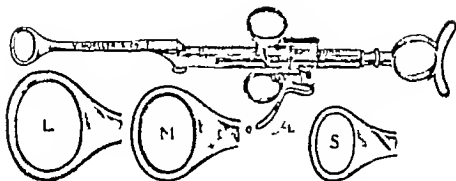


Fig. 6

Fig. 6 Instrument, developed by the author. Each of these turned the constrictor. It is simply, means supplied with a tube that has grooves in it for holding the wire loop. It uses the slower technique. The lower jaw and lifting the oral spreader into the suprapubic position.

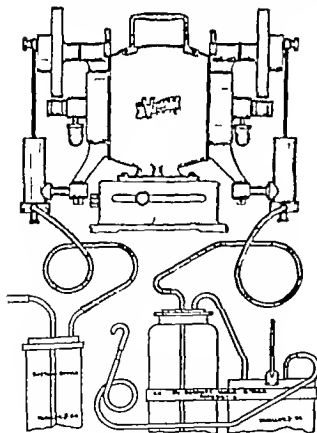


Fig. 7

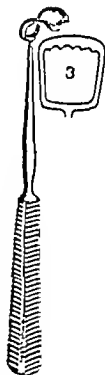
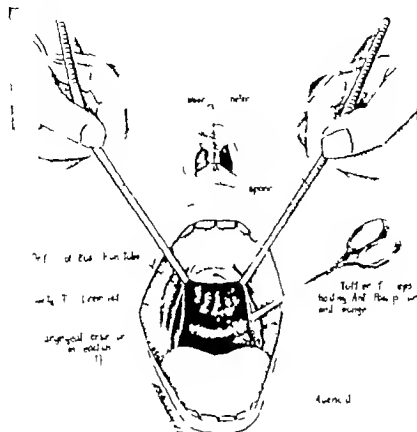


Fig. 8



Fig

curette had been recommended by Meyer for the nasal route and recently a specially curved ring curette has been recommended by Holmes, to be used by the aid of the latter's nasopharyngoscope.

We have found that the adenoid operation was the most unsatisfactory procedure in laryngology in that the work was done blindly and the results were far from perfect. There were several objections in particular and in developing a technique we strove to overcome them and believe we have succeeded fairly well in doing so. In the first place as to inspection of the region this we accomplish by passing a small size rubber urethral catheter one end through each nostril and out of the mouth. Holding these free ends in the left hand and pulling over the upper lip will bring the greater part of the posterior nasal cavity into plain view. By the aid of a large lingual mirror one will be aided in seeing the posterior choanae and the extreme lateral

aspect of the nasopharynx. The eustachian orifice can be seen directly by slight additional extension of the head a little to one side. One of the most interesting and surgically important points was brought out in the development of this part of the technique and that was the enormous size of the half a ring, or projection (Wulst) that formed on the posterior pharyngeal wall just out of sight when operating by the ordinary method especially when the patient is partially or not at all anesthetized. This half a ring or projection, is formed by the constrictors of the pharynx in the reflex action in the act of swallowing, or the moment the posterior wall is touched. It was a perfect revelation to us to note with what frequency this muscle was injured in the usual method of operating when we would inspect by this palatal retraction after operation. We believe that the soreness in the act of swallowing, complained of so often after the adenoid operation, is not

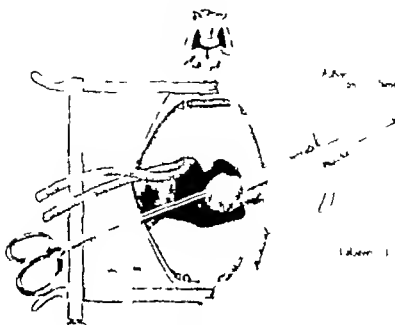


Fig. 11

tonillectomy of the same as for any major operation and we must that the patient lie in the house not less than 1 hour before operation and three days thereafter.

#### THE NEW OPERATIONS

The first record of the removal of the adenoid is by Meyer and this was performed by means of his snaring knife passed through the nostril but for the longer and a current devised by Gottstein and modified by many has been employed for the removal of the adenoid. In fact it is still the instrument of choice by the majority of laryngologists and the results are in most cases satisfactory. We will gain illustrate the principle of the various instrument and modifications thereto than point detailed description (Figs. 12-15).

Lowenberg was one of the first to describe for the removal of the adenoid premaxilla and after that many modifications are described.

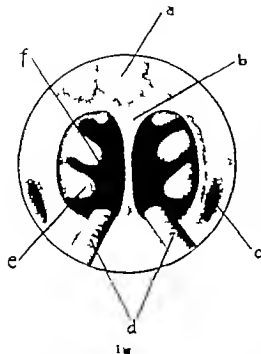
Griffith and Schuster were the first to describe a sort of a guillotine called the adenotome and this was modified by Lawson and finally La Force whose instrument became very popular especially in this country.

In this connection I wish to state that the

operation of tonsils and adenoids is performed by the general practitioner or rather it be performed by him is absolutely essential, especially in country districts or in localities far away from the location of an otolaryngologist. In view of this fact it is my opinion that such operation on the tonsils and adenoids, which will enable these same general practitioners to do the most satisfactory operation with the least amount of traumatism, is the best procedure that we can advise and that is true of the use of the adenotome especially the one devised by La Force for the removal of the adenoid and the Stoker principle, especially the one that I have adopted and will describe for the removal of the tonsil.

While we admit that the La Force adenotome prepared to avoid the possible complications caused by the current—namely injury to the septum, a possible with forceps, too deep removal of the adenoid shredding of the mucous membrane of the posterior pharyngeal wall and allowing the formation of a fistula—still, it did not permit to do a thorough removal, especially in the region of the eustachian tube and septal region of the soft palate. To overcome the former difficulty, I have developed a technique for the removal of the adenoid by the nasal route by means of a special devised biting forceps. A small ring





from infection but from the injury of the constrictor.

The next point is the method of removal. It has been the custom to remove as large a piece of the adenoid as possible with the first sweep of the curette in the median line, and then, usually in a curvilinear way to make a few passes with the curette on the side.

The next point was to control the bleeding, that is usually left to stop spontaneously. While this usually occurs, and not much blood is lost, still it is more than is necessary and it certainly detracts from the operation from the surgical standpoint to allow the bleeding to stop spontaneously. The bloody appearance of the field and after an adenoid operation or the sight of a child turned over the edge of the table to allow the blood to flow into the bucket, also has had a depressing effect on the writer. During the operative procedure, the suction apparatus keeps the field clear of blood, and as soon as the adenoids are thoroughly removed, a sponge mounted on an artery forceps is passed into the nasopharynx to control further bleeding by pressure. Removing this sponge and finding that bleeding has not stopped, one will usually observe one particular point of oozing, and that is in the median line. A straight artery

forceps, or even two or three applied to these bleeding points will always stop it permanently. All bleeding must be stopped before patient is returned to bed. The same is true with the forceps or the adenotomes. We have found in the immediate examination by means of our palatal retractor after such operation a denuded area with the muscles bare—and to a greater degree than necessary. At the same time, very frequently masses of adenoids are left in the regions where they do most harm—that is, in the region of the eustachian tubes. Usually the nasopharynx and nares were filled with a blood clot, and many times little tags of adenoids were seen. In one case the posterior lip of the eustachian tube was cut off. Aside from wanting the adenoid for histologic examination, or that one may be able to demonstrate to the parents that the adenoids were removed, there is no reason why we should remove one large mass with this large exposure of the muscles, which will surely require longer to heal.

The instrument that I now employ for the removal of the mass is an adenoid curette of the St. Clair Thompson pattern, without a guard, and with the cutting edge formed into a wave blade (Fig. 8). The motion of the instrument in the removal of the mass is not in the usual rapid, sweeping movement of the elbow wrist turn, but is from side to side and slow elbow wrist turn. The mass is cut off and remaining practically as is, however the last cut at the lower margin of the mass may require the use of forceps to hold it. Shredding of the mucous membrane is not possible under these circumstances, nor is it possible to cut off any of the muscle fibers of the constrictor fold, as I have seen in the operation when done by feeling alone.

The pressure exerted is very slight, since there is no attempt made to remove the entire mass at one time but simply to shake it down into the fibrous wall, which is situated on top of the muscles. We may say that a curette the posterior nasal space as one would enter the side of the nasopharynx, in the region of the Rosenmüller's fossa we employ any small straight ring curette or spoon.

The only departure from the above procedure is when it is desired to procure mass of denuded tissue for demonstration or examination purposes. Then the La Forge adenotome is used without much pressure and the operation completed in the regular manner.

The important practical factors in this technique are therefore

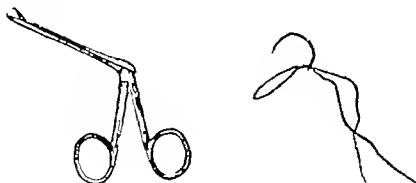


Fig. 1 Small alligator forceps for pulling loops through gland. Fig. 2 Needle threaded with loop to be inserted blunt end first. Fig. 3 Showing wires held by loops; additional turns being taken at each end.



Fig. 4 Wires in place with loops tied. Fig. 5 Lobe removed leaving grooved surface. Note extra turn of end ligatures around extremities of wires. Fig. 6 Raw surface lapped over with running suture.

## THE USE OF THE WIRE TOURNIQUET IN OPERATIONS FOR GOITER

By LEONARD FRITMAN M. D. Of COLORADO

THE ideal goiter operation should meet certain requirements: The average surgeon of limited experience should be able to perform it with rapidity, safety and confidence; hemorrhage should be easily and perfectly controlled; there should be no danger of injuring the parathyroid bodies or the recurrent laryngeal nerves; crushing or excessive manipulation of the thyroid should be avoided, especially when a tendency to hyperthyroidism exists; and it should be possible to remove with facility as much or a little of one or both lobes as may seem desirable.

The method in general use falls so far short of this ideal that many otherwise skillful surgeons approach operations upon the thyroid with hesitation which naturally tend to direct much of the goiter work into the hands of men of special training and experience.

I desire to call attention to an operation devised several years ago by myself which in most cases meets the above requirements better than any other procedure with which I am familiar.

**Operation.** The gland is dislocated in the usual manner through a collar incision. This means that the lobe to be removed should be freed bluntly generally by sweeping finger around it next to the capsule and lifted from it bed. This usually can easily be done so that the lobe may be grasped by the fingers, thus putting its attachment on the stretch and forming more or less of pedicle next the trachea (Fig. 3).

Several loops of heavy braided silk or better strong fishing line are then drawn through the substance of the lobe near its attachment. This may conveniently be done by plunging a small pair of blunt pointed alligator forceps (Fig. 1) through the gland, grasping it its center, ligature a foot long and dragging the loop into position. Several loops are required—one near each end and one or more in the center according to the size of the goiter (Fig. 4). If more convenient both ends of loop may be threaded through the eye of large round needle (Fig. 5) which is then passed blunt end first through the glandular tissue or an ordinary probe with an eye at one end may similarly be used.

As soon as the loops are in place, two wires are

adjusted, one on either side of the lobe, and tied tightly in place by means of the ligatures, thus forming a sort of tourniquet which compresses the base of the lobe firmly enough to control the circulation without crushing the tissues. This is easily accomplished by passing one wire through the closed ends of the loops, and upon the opposite side tying the loose ends firmly over the other wire (Figs. 3, 4, 7). Additional security may be obtained by again tying the loose ends of the two outer loops around the wires as they project beyond the gland (Fig. 3, 5, 6) and this should generally be done. If bow knots are used they may be untied and the loops tightened, if the tourniquet should prove to be too loose after amputation of the tumor as might rarely occur in the larger and softer goiters.

The size of the wire should be about No. 17. It should be capable of being bent without bending too easily. The German silver wire employed by dentists ("orthodontia wire") answers the purpose admirably. With a pair of cutting pliers the wires may be cut to appropriate lengths during the operation and perhaps bent to suit the requirements of special cases.

As soon as the tourniquet is properly applied, which can be done very quickly, the distal portion of the gland is cut away to any desired extent without the least fear of hemorrhage. The wound is next rapidly whipped over and over with catgut in round needle so as to close the raw surface and prevent subsequent bleeding. The application of this hemostatic suture will be facilitated if a sufficient stump is left beyond the wires and especially if the excision is made slightly deeper in the center than at the ends (Figs. 5, 6). The wires are then pulled out of the loops, thus freeing the litter so that they may be pulled from the tissues or if the iron stick, the loops may be cut.

In the majority of instances, the procedure goes surprisingly well and rapidly and after the gland has once been dislocated it is generally unnecessary to use either artery forceps or ligatures. Whether or not the superior thyroid arteries are separately tied is largely a matter of choice. I formerly brought the ends of the wires out through the skin incision and left them in place for several days before removing them,

## TWO-TIME TREATMENT OF ENCYSTED PERITONEAL ABSCESES

By W. A. BRYAN F. A. C. S., M. D. NASHVILLE, TENNESSEE

FROM the standpoint of treatment and, I may add, of prognosis, encysted abscesses of the peritoneum are divisible into two classes, viz. those in which the abdominal wall limits the abscess and those in which the abscess is walled off by adherent viscera leaving the abdominal wall free from any connection with the abscess, an arrangement in which the abscess may be looked upon as sustaining a relation to the abdominal wall similar to that of any normal viscus. Hence in the former type, if rupture toward the abdominal surface should occur it would permit a direct escape of the contents on the integument, while if the same direction of rupture should obtain in the latter type, the pus could only escape into the free peritoneal cavity.

Likewise from the point of prognosis, no one would hesitate to say which of the two he would prefer to deal with or in case of one's own person to have. In the first type there would be a simple incision and drainage with no fear of peritonitis, and in the latter either the pursuit of a devious time-consuming approach along a route not admitting pus to the general cavity or a change of the whole plan of operative procedure, which is time-consuming and attended with increased surgical risk in the case of weakened patients, or as is so often done, drainage across the free cavity which is always necessarily imperfectly often even poorly protected from the abscess contents by the wall of packing which surrounds the space lying between the opening in the abdomen and the opening in the abscess. Not a little mortality will be found attending the latter plan of procedure, and it will be higher as the operator is less skillful in abdominal work. While operating some months ago upon a patient of this kind, it occurred to me that it would be much safer if possible to convert type number two into type number one and that this would save time and the need of doing additional trauma by dissecting the peritoneum up until the abscess could be drained extraperitoneally. Surgeons have done two-time operations for similar conditions elsewhere, for instance, for abscess in the liver—why not here? A favorable point was selected for opening the abscess, the intestines were pushed aside as much as could be safely

done without a rupture of the abscess and a ring of gauze placed around this selected spot between the abscess and the parietal peritoneum, the opening in the gauze ring coinciding with the abdominal incision. In a few hours a wall of lymph seals the parietal to the visceral peritoneum and securely walls off the free cavity so that abscess number two has been converted literally into abscess number one and thereby rendered safe. Access to the proper point for puncture of abscess is made easier by placing a second plug of gauze through the wound and in the center of the ring, like a stopper in a bottle this is to be removed at the second operation, without disturbance of the ring. In my cases the time intervening between the two stages of operation has been ten to twelve hours.

The patients I have employed this plan upon are six in number. There has been no need of anesthesia in the second operation. The opening of the abscess is done bluntly or by inserting a pair of forceps according to Hilton's plan. An interesting feature in them all is that the temperature and pulse have dropped to normal or nearly normal regardless of the quantity of pus present, although it amounted to about two quarts in the last case. Her temperature was 103.5° F at 8 p. m. when the incision was made it was 99° F at 8 o'clock the next morning when the abscess was opened and drained. Likewise after the first operation the few cases I have had have been more comfortable after incising the abdomen.

I fully recognize the fact that my cases, six in number are too few to draw conclusions from, but they have been so satisfactory that this report is published for what it is worth. The principle is old, but I have not been able to find it recommended in this class of cases. In some cases it cannot be employed owing to inability to find a suitable point for doing the second operation after walling off. But it is conceivable that it might be serviceable to any operator at some time, and highly probable that many might do well to follow it as a routine as nearly as possible. It converts a more dangerous lesion into a less dangerous one without additional risk to the patient.

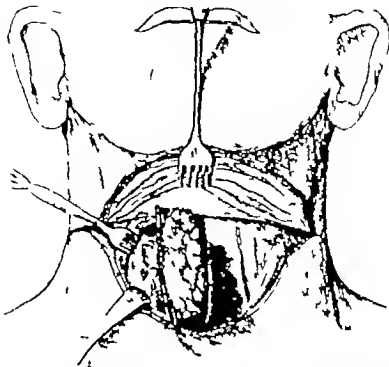


Fig. 7. Showing wire tourniquet in position ready to remove lobe. Note additional turns of end loops around extremities of wires increasing efficiency of tourniquet.

using, of course absorbable loops of catgut, but I have long since discarded this more cumbersome method in favor of the immediate hemostatic suture, although it might occasionally be useful when the tissues were particularly friable.

The wire tourniquet has a number of advantages—

1. It may be adjusted to almost any goster—by bending the wires if required, although this is seldom necessary.

The control of hemorrhage nearly always is perfect, so that the gland may be sliced off beyond the tourniquet with absolute confidence.

3. The tissues are not crushed—simply constricted, which is of importance in Graves disease at least.

4. There is no danger to the recurrent laryngeal nerves or to the parathyroids. Even if they should be caught in the grasp of the wires, which is unlikely, the compression would not be great enough to do them permanent injury.

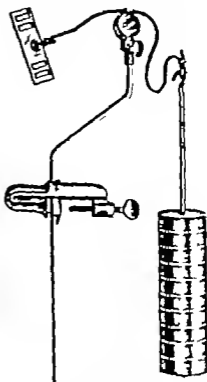
5. There is no chance of the wires slipping from the stump after resecting the gland, as might a pair of forceps, because they are held in place by the loops passing through the base of the lobe.

6. The wires are much narrower than the blades of a pair of forceps and take up less room.

It may properly be asked why an ordinary pair of forceps can not be used instead of wire clamp. There are several reasons. One is that forceps cannot always be applied, owing to the varying characteristics of goiters and the parts which surround them. Another is that forceps crush the tissues and may injure the nerves or the parathyroids, while a third objection is that when the lobe is cut away the forceps, being nothing to hold them, may slip from the stump and permit embarrassing bleeding.

I have used this method in some twenty goiters of various kinds, where it seemed to be indicated. The operations proceeded easily, safely, without anxiety and there were no fatalities.

The procedure is particularly adapted to parenchymatous goiters, of moderate size and excessive vascularity—as in Graves disease. It might be difficult to use in large goiters, and it would often be unnecessary in the simple excision of cysts and tumors. It is as the use of innumerable hemostatic forceps, the loss of considerable blood, as well as time and labor.



numerous extension apparatus hitherto used have been very deficient in their construction and inconvenient in their appliance. We have experienced the greatest difficulty with the various clamps in their adjustment into a fixed position to the bed frame rail. From the difficult adjustment of the different clamps to a bed, it occurred to me that we were in need of a universal clamp which could be easily and securely fastened to a bed. This idea has been carried out in a new invention which it is hoped will be approved and found useful by all surgeons.

This apparatus consists of a universal clamp, a round rod with a pulley at its top, a smaller rod for the weights (the weights being a pound each) and a footplate.

The clamp is composed of a fixed and a movable jaw and a thumb-screw. In fastening and

adjusting the clamp to a bed its thumb-screw is first unscrewed, then the movable jaw is pushed apart far enough from the fixed jaw to make the space between the jaws sufficiently large for the clamp to grasp the bed frame rail. The clamp is then applied to the rail, its fixed jaw to be placed anterior and inferior to the rail and the movable jaw posterior to it. Into the opening and groove of the movable jaw and in the space between it and the rail the pulley rod is inserted and adjusted into any position desired, then the thumb-screw is screwed on the movable jaw tight enough to fix the rod, clamp and rail together securely.

The pulley rod, being composed of an "S" shaped round rod, a scored pulley, surrounded by a flange and a small thumb-screw is universally adjustable.

## AUTOGENOUS FASCIAL TRANSPLANTATION

WITH REPORT OF THREE CASES

B. VICTOR F. MARSHALL, B. S. M. D., APPLETON WISCONSIN

Surgeon, St. Elizabeth Hospital, Appleton

**C**ONCERNING the subject of autogenous fascial transplantation the report of the three following cases is quite appropos.

**CASE 1.** Mr. J. Jensen, age 41, November 27, 1914. Referred by Dr. Hunt. Was admitted to St. Elizabeth Hospital to be on account of gunshot injury to the left hand. In the afternoon while out hunting and in crossing over log the gun was accidentally discharged. The entire posterior surface of the hand with the second row of carpal and first metacarpal bones were destroyed. The extensor tendons were destroyed. Hemorrhage had been quite profuse but had now ceased. Under ether anesthesia the wound was cleaned, the remaining fragments of the metacarpals and carpal removed and the thumb fragments trimmed. The tendons were sutured. The hand was materially shortened but this was deemed superior to an artificial hand. Sepsis occurred and the union of the tendons gave way. Upon cessation of sepsis and continuation of the wound, effort was again made to unite the severed tendons. Accordingly on January 1, 1915 the second operation was carried out. Through a crucial incision with reflection of skin flaps, and after some effort, the ends of the severed tendons were found and union again accomplished. The annular ligament was quite badly destroyed. To cover over this defect and to cover the tendons to protect the tendons and prevent adhesions to the scaphoid, fat and fascial graft from the right thigh was taken. The graft measured two by three inches and was sutured over the tendons and annular ligament. Union

of convalescence and union followed with restoration of function.

**CASE 2.** Miss M. V. Age 32, January 23, 1914, entered St. Elizabeth Hospital for the removal of a tumor involving the external oblique region, and also for a second of the uterus. The tumor involved the ventral wall and was slightly to the left of the old scar of previous laparotomy eight years before for left ovarian cyst. Under ether anesthesia the tumor excising fibrous was removed from the abdominal wall. The muscles were not involved in the growth. An area two by three inches of fascial wall was removed. A suprapubic hysterectomy was done. To close up the large defect in the abdominal wall fat and fascial graft three by four inches was taken from the left thigh and transplanted. Healing occurred by primary intention and convalescence was uneventful.

**CASE 3.** M. L. Blacksmith, age 57, large, corpulent man. Entered St. Elizabeth Hospital February 8, 1914, for hernioplasty for large hernia of the left inguinal region. The hernia proved to be a large sliding hernia of the sigmoid. The sigmoid was freed and flap of peritoneum located on either side and sutured posteriorly and the sac returned to the abdominal cavity. A hernia repair was now made of the hernial opening. It was impossible to close the external ring owing to sparsity of lateral tissue—the defect being an area of two and half by two and half inches. A fat and fascial graft was now taken from the patient's right thigh and sutured over the defect. Healing occurred by primary union and convalescence was uneventful.

## DEMONSTRATION OF A UNIVERSAL EXTENSION APPARATUS APPLIED TO A SURGICAL BED

By CARL G. SWENSON M. D. CHICAGO

Attending Surgeon, Parkland Hospital

**F**OR convenience and durability a metallic footplate was devised and made. This plate has four bars and a loop-piece. The loop-piece is for the attachment of the pulley cord and the bars for the attachment of adhesive plaster strips. These strips, one by two inches in size, being doubled, are to be applied in loop form around two of the bars and the bars are to be selected according to the width of the extremity.

In fastening the plate to an extension, for example of the lower extremity the loop strips around the bars are simply fastened by safety pins to the ends of the adhesive plaster strips

which have been previously applied to the leg. The lower ends of the adhesive strips applied to the leg should be doubled upon themselves to a point just above the ankle.

A desired number of pound weights are then placed on the smaller rod and this rod is connected in suspension by cord to the footplate.

The advantage of this extension apparatus is that it may be conveniently and quickly applied to a bed and patient securely. Furthermore it is positively self-adjustable and universal in its applicability to the various forms of wood and metal bed frames in use.

It is believed that every one will agree that the

## SLIDING SPLINT OF PLASTER OF PARIS FOR FRACTURED FEMUR

B. JAMES T. HANAN, M. D. MONTCLAIR, NEW JERSEY

AS far as I have been able to ascertain, the splint about to be described is a new departure in the apparatus treatment of recent fractures of the thigh.

I have used it now for over a year in seven cases, applied to children and adults of weak and strong musculatures.

The splint is easy to make provided one is familiar with plaster of Paris. It takes about thirty minutes to complete, and keeps in good condition for six or eight weeks.

Reduced to the simplest form of description, it consists of a plaster cast of the leg and one of the thigh to which is attached a board slide with slide extensions about three inches long and two and a half inches wide to overcome rotation of the leg; this entire board is thoroughly greased with vaseline before being attached behind to the thigh and leg splints by eight or ten turns of a plaster bandage and is therefore *free to move within its casing*, a sliding effect is thus obtained that allows for such traction upon the lower fragment as may be desired and consequent extension of this part.

The points of interest connected with it are: An accurately fitted splint to the contour of each limb treated, traction and extension in a direct line from hip to foot, prevention of rotation of the extremity, a constant flexed position of the foot overcoming any tendency to equinus, the avoidance of leg bandages and thigh coaptation splints, the easy and quick exposure of the entire leg and thigh for dressings or inspection, and its cheapness and simplicity—a total cost of about three dollars being a maximum.

Application (under surgical anesthesia):

1. The limb is cleansed with soap and water shaved if unduly hairy and washed with ether and alcohol.

2. The usual molarin traction straps for Beck's extension are applied and the lower ends folded under the arch of the foot.

3. Moderately strong extension, to reduce the deformity is made by an assistant holding the foot at a right angle.

4. Sheet wadding in rolls or a flannel bandage is snugly applied from the foot to the knee and from just above the knee to the groin.

5. A Gish saw is placed on each side of the leg and thigh, kept in place by a bit of adhesive plaster and later used to split the casts into anterior and posterior splints.

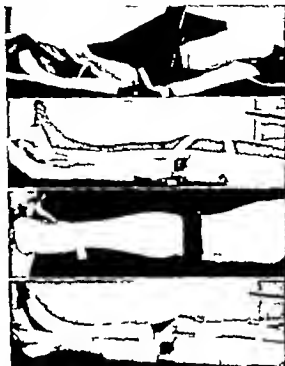


Fig. 1. Shows the completed cast dismantled and the upper and lower anterior and posterior splints formed. In the posterior leg splint is seen the lower opening X in which the board piece slides. Also in the center is the wooden key-space made of whitewood or pine, or what is preferable oak or ash, in length long enough to reach from the middle of the calf to the middle of the thigh (in adults from fourteen to fifteen inches), in width three and one-half inches and one-fourth to five-eighths of an inch thick the side struts to further extend laterally three inches and be a length of about 1 and one-half inches. The straps of one inch webbing with buckles attached complete the picture.

Fig. 2. The apparatus completed but showing the upper splints removed for inspection or dressings.

Fig. 3. The wooden slide is seen with the dotted lines indicating its extent in plaster of Paris.

Fig. 4. The completed cast splints in place bound with cotton plaster and held in place by the straps of webbing padding placed in popliteal space to support the knee and extension in force. A bandage ring under the heel and the sand bags have been omitted to facilitate a clearer view of the splint.

6. Three or four three-and-a-half or four inch plaster bandages are successively and snugly applied to the foot and leg as high as the tubercle of the tibia and the same number from

## A MODIFICATION OF ABBOTT'S FRAME FOR APPLYING SCOLIOSIS JACKETS

B. VALBERT H. FREIBERG, M. D., F. A. C. S. CHICAGO, ILL.

IN using Abbott's frame for the application of scoliosis jackets the writer has several times found it disadvantageous that the three cleats on each horizontal rod could not be revolved independently of one another. This is due to the fact that in working the ratchet which

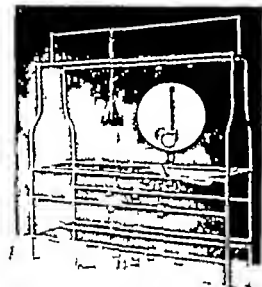
ratchet mechanism, furthermore adds very greatly to the expense of the apparatus.

In order to obviate the disadvantage above mentioned and, at the same time, promote simplicity in construction, the writer has had a frame constructed which has been thoroughly tested by use and found entirely satisfactory. It is also worth mentioning that this construction reduces the cost of the apparatus to a considerable extent.

Instead of the cleats being fastened by thumb screws to a tube which revolves in its whole length always, they are attached to sleeves eight inches long (a) which are turned out of heavy-walled steel tubing. At the thick end of each sleeve a number of holes are bored, by means of which a spanner wrench (b) may be engaged. The correcting band having been wound around the sleeve at (c) and caught in the cleat (c), the wrench is used to secure the desired tension which is then held by tightening the thumb screw (d). No difficulty will be encountered in securing any degree of tension in the correcting bands. It has not been found necessary to have more than two revolving sleeves on each horizontal bar. Within the circle in the illustration there may be seen an enlarged view of the wrench engaged in the sleeve.

In using this frame the writer has found it very convenient to have a mirror placed on the floor below the patient. By this means it is possible to view the under (or posterior) side of the jacket as it is being made and without having to stoop.

By having the uppermost horizontal bar (e) placed two inches higher than on Abbott's frame this may also be used for the application of plaster jackets in vertical suspension.



is found on each horizontal member of the apparatus, the tube to which all three cleats are screwed fast, revolves. There are eight such revolving horizontal members each one having a ratchet mechanism similar to that indicated by X in the illustration. The reduplication of this

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2. The usual moleskin traction straps for Buck's extension are applied and the lower ends folded under the arch of the foot.

3. Moderately strong extension, to reduce the deformity is made by an assistant holding the foot at a right angle.

4. Sheet wadding in rolls or a flannel bandage is snugly applied from the foot to the knee and from just above the knee to the groin.

5. A Gill saw is placed on each side of the leg and thigh, kept in place by a bit of adhesive plaster and later used to split the casts into anterior and posterior splints.

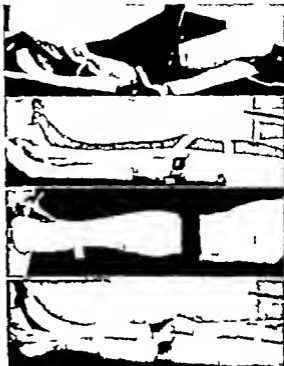


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Fig. 2. The apparatus completed but showing the upper splint removed for inspection or dressings.

Fig. 3. The wooden slide in situ with the dotted lines indicating its extent in plaster of Paris.

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6. Three or four three-and-a-half or four inch plaster bandages are successively and snugly applied to the foot and leg as high as the tubercosity of the tibia and the same number from

above the knee to the gluteal fold. (Up to this point the technique is that of ordinary plaster casts of the thigh and leg, with the exception of placing the Gigli saws for cutting purposes.)

7 The well vaselined wooden slide is now applied posteriorly with the struts or side extensions midway between the upper and lower casts and fixed firmly in position by turns of a plaster bandage above and below the knee.

8 In about ten minutes after their application the casts are split by the Gigli saws into anterior and posterior splints and the separation continued from the malleoli forward to the sides of the toes by a sharp knife.

9 The top of the leg splint is now lifted off, and the traction straps, which have been folded under the arch of the foot during application of the leg cast, are pulled out and made fast to the weight of an ordinary Buck's extension.

10 Two straps of webbing are drawn about each splint to retain it in position.

11 Sand bags are placed on the outer and inner sides of the extremity to steady it and make pressure on the lateral struts, and the apparatus is complete.

At a later date the splints may be bound with adhesive plaster to give a finish.

As the swollen thigh shrinks, fresh layers of sheet wadding or cotton are placed beneath the anterior upper splint.

Two or three of the wooden slides, for adults and children, are kept on hand and the only other things necessary for the apparatus are the Gigli saws, molaslin or adhesive plaster and the bandages.

The casts may be cut with a knife instead of the wire saws, but it is a much more laborious procedure.

In my first casts I used for the wooden slides a number of ordinary bearwood computation splints, so that the more finished article is not imperative but makes a much more rigid splint.

With the cases in which it has been used there has been less than an inch of shortening in several, none at all, and in others, three quarters of an inch or less.

Up to the present time there have been no instances of non-union and the series comprises individuals from the young to beyond middle age.

## DILATATION OF AN OTHERWISE IMPASSABLE STRICTURE BY THE RETROGRADE PASSAGE OF A FILIFORM GUIDE

BY A. J. UNDERHILL, M. D. BOSTON

THE procedure herein described was used on a patient on whom it was impossible to do a more radical operation under general anesthesia because of his general physical condition. He was referred to me by Dr. Brent who was called in an emergency to relieve a complete retention of urine, which came on during convalescence from a severe attack of pneumonia complicated by a bad heart lesion. The right lung was still consolidated.

The patient had a stricture of the urethra at the bulbomembranous junction which had troubled him at intervals for the past fifteen years and finally at the time I saw him had resulted in complete retention of urine. After an unsuccessful attempt to pass catheter or filiform bougie it was necessary to separate his bladder. Morphine hypodermically, warm sitz baths, and other measures were used to enable him to pass his urine voluntarily but without success. A second attempt to pass filiform the next morning and third one a few days later also proving unsuccessful, the patient finally consented to enter hospital. His family physician had been relieving him by separating his bladder at the meatus.

The patient entered the University Hospital, December 30, 1913. suprapubic opening was made in the bladder under local novocaine anesthesia, and drainage tube inserted. On the second day following the operation he had an attack of nausea and vomiting which lasted about without intermission for three days. Temperature during this period ranged around 97 degrees pulse 60. Intra-venous phenolphthalein was given but at the time (done by passing a small soft rubber catheter through the drainage tube and withdrawing the urine with a syringe after first washing out the bladder) gave eighteen per cent as the first half hour time of appearance was minutes. An examination of the blood for the urea content showed 20 mg. per 100 cc., demonstrating that the above attack was probably uræmic in origin. As perineal operation under these conditions was inadvisable I adopted the following procedure.

A metal catheter was cut off below the eyelet and the shaft shortened until the instrument including the curve was 18 cm. in length, the curve remaining was straightened to about 60 degrees. A filiform guide was obtained which at one end had a male thread cut to the same dimensions as the thread on the end of my Le Fort followers. The thread fitted of course the female thread in the ends of the filiform guides which were adapted to the followers.

The patient was placed on the table, the drainage tube

removed from the bladder and the metal catheter altered as above described, passed into the opening left by the removal of the tube. A Nitze observation cystoscope was inserted in the same opening between the catheter and the umbilicus, and while an assistant kept the bladder distended with continuous stream of sterile water through needle placed at the suprapubic opening, the interior of the bladder could be examined with ease through the cystoscope and the urethral orifice; the bladder located. Holding the cystoscope by the fingers of the left hand the end of the catheter was placed at this opening; both instruments are then grasped in the same hand and the two Bismuth guides, joined end to end, were threaded through the altered catheter thus used both as a director and as a means of preventing the kinking of the flexible guides. The two instruments joined as described were pushed into the prostatic urethra and through the opening of the stricture with but little resistance until the small end of the first guide appeared at the meatus. This was grasped and drawn through, pulling the second one with it. When the joined ends of the two guides appeared at the meatus the first one was detached, replaced by No. 14 Fort follower which in turn was pushed back through the stricture. This guide was then tied in the urethra for forty eight hours, until after subsequent dilatation with larger follower when it was removed. Dilatation was then continued at intervals, as is usual in such cases, until the normal caliber of the urethra was restored.

The anterior aspect of these strictures is often mutilated and distorted by previous attempts to pass instruments with the result that the passage of fillforms by the ordinary route is rendered impossible because of tags, false passages, blood-clots, etc., which destroy the more or less funnel shaped orifice to the strictured canal. The cul-de-sac formed by the bulb, if not completely obliterated by the scar tissue, adds to the difficulty of entering a fillform at this point. The instrument in its retrograde passage in the case described followed a virgin route and passed without difficulty the posterior entrance to the stricture probably forming a funnel which guided the instrument into the narrowed lumen of the urethra.

While an external urethrotomy under ordinary circumstances is the more desirable operation in dealing with impassable strictures in this region the above method may be a good substitute in instances where the patient's condition will not admit of a general anesthesia with the sometimes long and tedious manipulations required in doing this operation without the aid of a guide.

# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

A REGULAR MEETING WAS HELD APRIL 30, 1914, WITH THE PRESIDENT  
DR. M. L. HARRIS IN THE CHAIR

### SARCOMA OF THE HUMERUS — BONE TRANSPLANT

DR. ALBERT E. HALSTEAD I wish to report a case of sarcoma of the upper end of the humerus.

The patient, 7 years of age, was operated on in July 1913. The history of her trouble dates from April, 1913. Following kick from horse, pain, swelling, and loss of function called attention to growth in the upper end of the left humerus, which upon examination proved to be a medullary sarcoma.

The upper half of the humerus was resected and bone-graft from the tibia implanted. The union between the graft and the remaining portion of the shaft was accomplished by rasping out the medullary cavity of the upper end of the shaft and driving the end of the graft into the medullary cavity of the fragment of the humerus remaining after resection of the upper half. The graft was covered on two sides by periosteum. That at the lower end of the graft was united to the resected periosteum of the remaining portion of the humerus.

The first radiogram was taken about two weeks after the operation the original cast was still on. This shows the graft alive and no evidence of absorption present. You will notice one point where the graft is rather thin, but it is beginning to thicken. It has become round, and the union between the two fragments is evident.

The next radiogram was taken a week after operation, the girl having gone home, and returned for examination. You see how much thicker the graft is and how it has grown. The other radiograms were taken at intervals of about six weeks, the last one in January, 1914. This shows that the union is complete. The graft is practically the same size as opposite the humerus. There is free mobility of the joint, although abduction further than right angle is impossible. There is no pain or disability in any way except limitation of motion so far as abduction is concerned.

This case demonstrates that a graft, when nutrition is adequate thrives from the first and does not undergo absorption. At no time was there any evidence of rarefaction or disintegration of the graft. The bone remained viable and gradually grew until the thickness of the graft equaled that of a normal humerus.

In a second case in which grafting was done, the first graft made to replace the lower end of the radius was entirely absorbed. The radiogram showed gradual disintegration of the bone until finally only a thin, white, silvery strip, indicating the periosteal covering on the graft, remained

From this gradually developed new bone until the graft reached the thickness of about five-eighths of an inch. In this case it was evident that the nutrition was not sufficient to maintain the vitality of the graft and that absorption followed, the regeneration taking place in the osteoblasts in connection with the lower layer of the periosteum. In the same case subsequent grafting of the lower end of the ulna was resorted to. In this the graft remained intact and grew from the first. In both instances the graft was taken from the tibia and was covered on two sides with periosteum and on the third side medullary tissue formed part of the graft. These two cases bear out the contention of McWilliams of New York that the vitality and subsequent growth of the bone-graft depends upon its nutrition, and that the osteoblasts in a bone graft depend upon its nutrition and that the osteoblasts in a bone-graft proliferate and from these new bone is developed, and that although bone does not originate from periosteum yet the presence of periosteum on a graft makes the subsequent life of the graft more certain by assuring a quicker blood supply to the graft or by maintaining the vitality of the osteoblasts until the adequate blood supply is established.

DR. CARL G. SWENSON demonstrated a universal extension apparatus applied to a surgical bed. (See p. 114.)

DR. COLMAN G. HURFORD read a paper entitled Resection of the Tibial Diaphysis Partial Regeneration Tibial Transplantation, with exhibition of several radiograms.

DR. KILLGUS SPERRY read a paper entitled Discussion of Pott's Fracture with Complications Based on 308 Cases. (See p. 73.)

### DISCUSSION

DR. D. N. LEBENOWITZ: I think we are all indebted to Dr. Speed for his most painstaking study of these cases. Those who have had experience at the Cook County Hospital know

what a hopeless task it is to delve through the histories, and the system of filing X-rays, is unfortunately very inadequate. I would plead for a change in our nomenclature and the manner of teaching students the definition of Pott's fracture. The definition of Pott's fracture as given originally by Pott is inadequate. It is just as inadequate as the term Colles' fracture at the present time. Since the X-ray is used systematically in all cases, especially in our largest cities, we now know the old term Colles' fracture applies only to a small portion of the fractures at the lower end of the radius or forearm. It is better in teaching students, especially when it comes to the use of the term Pott's fracture to extend the term Pott's fracture as applying to that particular variety but since we know them better we speak of them as fractures of the lower end of the bone or both bones of the leg.

I think we ought to standardize the histories of fractures more. There is an effort being made by the Committee on Hospitals to try to do this.

Within the last few months, or since the first of the year I have attempted to make up X-ray tracings of every fracture or the number of other conditions which can be helped by X-ray tracings that is, take a piece of ordinary tracing paper and pressing on a piece of paper and finally adding it with the history sheet. We ought to familiarize ourselves, without taking the trouble to look-up the X-ray, with the condition of the patient four weeks after fracture has occurred and when treatment was begun.

I have discarded the use of ordinary wooden splints or blanket splints except as a temporary measure or all fracture boxes, and I want to emphasize one point, and that is, as soon as possible to anesthetize the patient as soon as we have taken an X-ray and put him up in some sort of temporary dressing which will not allow of any displacement. I find for that purpose, especially for the hand and foot, a moulder of plaster of Paris splints is very useful. We have used it for many years at the County Hospital. The trouble with many fractures of this kind is, we put them up temporarily in a blanket splint and this displacement is not corrected as it ought to be, and when we come to anesthetize the patient in a week or ten days a certain amount of callus has taken place and it is difficult to get a good anatomical result.

Dr. Speed neglected to call attention to two types of cases in which we have a good deal of trouble around the ankle-joint one is the impacted fracture of the tibia or fibula, and the other is the spiral type. Several of his pictures show this

beautifully. The upper end of the tibia is impacted into the lower end in such a way that correction becomes very difficult, and it is not until we actually get much freedom of motion at this point that we can hope to get any sort of results.

He laid emphasis upon a very important point, and that is not permitting patients with fractures of both malleoli, and with them laceration of the lateral ligaments, to step on the foot too early. That is a mistake we make frequently. When we allow a patient to step on the foot four weeks after the injury the result is that it is not as useful to the patient as it ought to be, and so he has great impairment of motion, and, what is more important, has a traumatic flat foot. A great many of these cases have disability for months because we have neglected to think of not only fracture having taken place but laceration of the ligaments.

I was very glad to have him call attention to one point and that is the importance of a wedge getting in there and preventing correct apposition and preventing good movement of the foot later on.

Dr. Speed (closing) My first interest was attracted to these cases by a number of instances of Pott's fracture that had come back to the hospital. After they are discharged they are out a few weeks and acquire this flat-foot due to improper shoes and improper walking and insufficient hardening of the callus. If you will take a picture four or five or six weeks following a fracture, the bone seems to be firmly united and the callus is in good shape. Let a man go out and do laboring work and carry a heavy burden you will find a loosening of the callus and deformity returning. That is the reason these patients should have prolonged immobilization until the callus has hardened and settled down and until the ligament is firmly united. The ligaments, as the pictures show are extremely important in these cases when you consider the astragalus is swung and carried by the ligamentary structures far more than any bone.

Dr. B. D. Phemister presented specimens of Retention Cyst of the Appendix.

#### RETENTION CYSTS OF THE APPENDIX WITH DEMONSTRATION OF THREE SPECIMENS

Dr. B. D. Phemister Chronic retention of secretion in the vermiform appendix producing a cyst like hydropic swelling of the distal portion of the organ is of relatively rare occurrence. It results from a gradual narrowing of the lumen in the proximal portion of the organ, developing usually as a result of a mild attack of appen-

dititis, but in many cases without any previous history of appendix trouble. Most of the cases have occurred after the thirty-fifth year. The process is closely associated with the normal involution of the appendix and appendicitis obliterans.

The changes in the wall at the seat of obstruction are variable. In most instances the lumen is obliterated, while in others only narrowing or angulation is present. The obstruction is usually located at the cecal end, but it may be at any point along the course of the organ. Occasionally there is obliteration of the distal and proximal portions leading to a cystic dilatation of the middle portion. The dilatation may be of the appendix alone in which case either a spherical or a sausage-shaped swelling results. In some cases the dilated appendix is accompanied by a diverticulum while in others the entire swelling consists in one or more diverticula, the wall of the appendix elsewhere being sufficiently resistant as not to dilate. The changes in the wall of the dilated appendix vary according to the amount of distention. In the milder grades the various coats are retained but the mucous membrane is flattened out and the fibrous tissue of the wall is increased. In more marked cases the musculature disappears and the wall consists of fibrous tissue with a very thin mucous lining which is frequently calcified in many places. In extreme cases mucous membrane partly or wholly disappears.

The sac is usually filled with a thick mucous content which upon chemical analysis is found to consist chiefly of pseudomucin. These cases were formerly mistaken for colloid carcinomata of the appendix, a condition which subsequent observations have shown to be extremely rare.

Accidents which happen to a mucocele of the appendix are infection and perforation. Infection is rare and may bring on the symptoms of an acute appendicitis or convert the cyst into an empyema of the appendix. Perforation is fairly common but no acute symptoms of peritonitis result from it, as the contents are nearly always sterile. The perforation may remain open indefinitely or after a time it may close. Masses of the mucous contents escape into the peritoneal cavity and produce one of two conditions. They may remain in the region of the appendix and become encapsulated and converted into cysts by the growth around them of a fibrous covering from peritoneum. In other instances where the secretion is extensive these masses become scattered throughout the general peritoneal cavity. They set up irritation and exudation, become attached and encapsulated and produce the condition known as pseudomyxoma

peritonei. Sometimes epithelial cells are current with the pseudomucin and proliferate, producing a picture simulating implantation metastasis in carcinoma, but the history of these cases subsequent to removal of the appendix or closure of the perforation is that they clear up and very seldom end in malignancy.

The three specimens to be shown illustrate three types of the condition: first, a large mucocele of the entire appendix; second, a mucocele with perforation and pseudomyxoma peritonei; and third, a diverticulum of the appendix. The first specimen is from a thirty-six year-old woman operated on by Dr. Dean Lewis. She had noticed a swelling in the right lower quadrant of the abdomen for one year which had gradually increased in size. It produced no symptoms until three months before operation when she began having a dull ache in this region and soon backache. There was never any severe pain and no history of a previous attack of appendicitis. Examination showed a cystic swelling in the right lower quadrant which was thought to be an ovarian cyst. At operation it proved to be from the appendix, and the genitalia were free from disease. The entire appendix was involved, the cyst being sausage-shaped, measuring 17 cm. in length and 31 cm. in its greatest circumference. The wall was everywhere thin and translucent, but in a few areas there were plaques from fibrous thickening. It was filled with thick gelatinous material which after hardening did not escape from the small windows excised from the wall. Microscopically the wall consisted of fibrous tissue with a mucous covering in some areas but with calcification along the surface and complete absence of epithelium in others.

The second specimen is similar in structure to the first but somewhat smaller in size. It was removed in 1907 by Dr. O. T. Roberg from a woman forty-six years old who came because of a left inguinal hernia, the existence of the movable swelling low down on the right side not having been noticed. There was no history of previous appendix trouble. At operation the peritoneum was studded everywhere with gelatinous masses, large numbers of which were removed from the sac of the hernia and from the cul-de-sac of Douglas. The thin-walled cystic appendix was about 3 cm. long and 15 cm. in circumference. It was filled with a thick pseudomucous material and a small perforation was present through which the gelatinous contents escaped into the peritoneal cavity. The case was thought to be one of colloid carcinoma of the appendix at the time but after removal all

the symptoms disappeared and the patient is still living and well.

The third specimen from the museum of Rush Medical College is a diverticulum of the appendix about the size of a small grapefruit which was removed from a woman forty-eight years old during an operation for ovarian cyst. It has been carefully studied and reported by Dr. Isabella Herb. The proximal portion of the appendix is obliterated but the organ is only slightly dilated. The diverticulum comes off from the region of the mesenteric lumen and its wall is extremely thin, consisting entirely of fibrous tissue. It was filled with the same pseudomucinous material as was found in the other two cases.

#### FIBROMA OF THE APPENDIX

DR. SAMUEL C. PLUMMER. I wish to show a specimen of fibroma of the appendix. It occurred in a young man who gave a history of recurrent attacks of appendicitis of mild degree. This mass could be palpated through the abdominal wall and naturally it was thought to be a concretion. It proved to be a fibroma, however, and was about the size of a hazel-nut.

DR. NELSON M. PERCY. This appendix I show you was removed in January of this year from a patient, 55 years

of age who gave typical history of gall-stone trouble but not of appendicitis, although examination revealed tenderness over the region of the appendix. When the gall stones were removed, an examination of the appendiceal region revealed this large cystic appendix. The cyst was nearly double the size it is now, being about five and one half inches long and two and one half inches at its greater diameter. It contained gelatinous fluid and in the top of it was a hole through which leakage occurred.

About six months ago we encountered another case at St. Mary's Hospital which was about two-thirds as large as this one, but through a mistake of the interne the specimen was lost. Neither one of these patients gave a history of having had an attack of appendicitis.

DR. PIERCE (closing). There are several things that might be mentioned, one of them the association of cyst of the appendix with cyst of the ovary which makes this condition of pseudomyxoma peritonei. The appendix has apparently become secondarily involved in quite a number of cases, and it is hard to say whether the appendix or the ovaries are the cause of the condition.

I would like to hear from some of the older men regarding the question of chronic empyema of the appendix and if they have seen any of those cases.

## CHICAGO GYNECOLOGICAL SOCIETY

A REGULAR MEETING WAS HELD MARCH 20, 1914, WITH THE PRESIDENT  
DR. FRANK W. LYACH, IN THE CHAIR.

#### ABDOMINAL PREGNANCY

DR. THEODORE J. DORDERLEIN reported the following case:

Mrs. B. Family history negative, had her last menstruation about the middle of April, 9. She claims she observed nothing abnormal during her pregnancy and felt very active like up to one week before labor commenced. Typical, periodical pains started in the night before the twenty-third of January somewhat later than labor was expected. In the morning I was called in consultation by Dr. Gerner, who had noticed regular pains and the unusual state of affairs during the time he was in the house.

I found the patient well built woman with normal pelvic diameters and enormously distended abdomen. On the left side the only covering over the fetal parts seemed to be the thinned-out skin. On the right side a large boggy mass could be outlined. A vaginal examination yielded nothing but short vagina, large indistinguishable mass protruding and brace of cervix set out. On using much force the finger followed cervix high up toward the left parametrium. I concluded that for some reason the uterus had turned backward, as is found in retraction

in the cavity of the uterus or after enterofixations. The patient was removed to the German Hospital, the genitalia shaved and disinfected in the delivery room and another examination made under anesthesia. I now could reach the small undilated cervix high up in the left vaginal fornix and with great difficulty succeeded in introducing my finger into the uterus and found it empty. It now was obvious that we had to deal with an abdominal pregnancy and the patient was taken to the operating room.

On opening the abdomen through a median incision I found this mass on the left and conglomerate mass of omentum, intestines and placenta on the right side. The placenta was large and thin, and adherent to the serous surfaces of intestines and parametrium. The sac was emptied of its contents consisting of two fully developed fetuses and a large amount of fluid. Each fetus weighed about six and one half pounds. Believing that the danger from simple drainage of the sac would be as great as that of extirpation of the entire mass, including the uterus, I commenced below making supra-vaginal amputation and dissecting upward. At first matters progressed rapidly but higher up the adhesions were so intimately adherent that dissection was most

difficult and tedious. So it happened that an apparently innocent looking strand of peritoneal adhesions high up on the tumor upon cutting proved to contain a loop of intestine. A burned end-to-end anastomosis was made and after the abdomen was opened clean I proceeded to peritonize very carefully. I believe that this saved the patient. Although there was good deal of hemorrhage and the patient's pulse was very high the first twenty-four hours she really made an uninterrupted recovery and at present enjoys perfect health. Unfortunately the forniceae were not allowed to remain with this severe pathological specimen.

#### MALIGNANT TUMORS OF THE OVARY

**DR. EMIL RIES.** Some time ago I demonstrated to the society a specimen that had been obtained from a patient of mine and, at the same time, discussed the question involved in the case, the origin of bilateral malignant tumors of the ovary and referred to the limited number of cases reported in the literature which demonstrated fairly clearly that all of these cases, if carefully examined proved to be metastatic, not primary. At the present time, whenever we find a bilateral malignant tumor of the ovary our diagnosis is not complete unless we have excluded the presence of a malignant primary tumor either in the intestinal tract or in the gall-bladder.

The patient, whose specimen I wish to demonstrate to you, is a female, fifty-seven years of age, who was sick for several months, with loss of flesh, severe stomach disturbance, lack of appetite, and gradual swelling of the abdomen and legs. The abdomen became so filled with fluid that her physician tapped her some three weeks before she came under my observation and removed a considerable amount of fluid. The fluid was serous, sanguinolent and came in the quantity of some quarts. After the tapping the physician was able to feel a tumor in the region of the umbilicus, although he was not sure of its nature. I did not see the patient until the fluid had reaccumulated, and the tumor which he had been able to make out in the region of the umbilicus was then not palpable, on account of the quantity of fluid which, as you present. On vaginal examination I could feel two tumors, one on either side of the uterus and diagnosed from their hardness, from the age of the patient, from the symptoms and from the fluid in the abdomen that they are malignant tumors of the ovary and also made the diagnosis that they must be secondary to something else. As these tumors compressed the rectum, and as it was possible that I might be able to remove the metastatic tumors of the ovary as well as the tumor of the intestinal tract of such one was present, I undertook the operation with the intention of removing both. On opening the abdomen we had the escape of considerable amount of fluid again. I then immediately saw the tumor which the doctor had palpated in the region of the umbilicus. It was a tumor of the omentum. The whole omentum was changed into a borborygmic mass, so that there was no healthy omentum to be seen. This mass was attached to the transverse colon and kept the transverse colon perfectly rigid. In the pelvis are the two ovarian tumors as diagnosed. The small intestine showed no tumors. The gall bladder was free. On the lesser curvature of the stomach attached to the liver by adhesions, as hard tumor, nodular

evidently malignant. In the presence of the tumor of the omentum it was clearly out of the question to do radical operation. It was questionable whether it was wise to leave the ovarian tumors alone, but as the tumors had developed between the uterus and rectum and compressed the rectum, I considered it wise to remove the ovarian tumors to give the patient a chance to have regular action of the bowels. I did this particularly because in similar case some years ago, in which we found the ovarian tumors inoperable, the woman ultimately died from complete compression of the rectum with ileus. In this case I removed the two ovarian tumors without any difficulty and the woman so far has made an easy recovery. The fluid is already reaccumulating.

Microscopic examination of the tumors removed shows that they are distinctly of a type which does not belong to the ovary. They are distinctly adenocarcinomatous, such as we would expect to find in the stomach or intestine, the cells showed a secretion of mucus as in adenocarcinoma of the stomach or intestine.

The case is interesting as confirming again the fact that these bilateral malignant tumors of the ovary are practically always secondary to some primary tumor in another location, and that it is not sufficient to try and remove these tumors, but we should try to remove the primary tumor also if it is possible to do so. Asami, of Munich was able to do resection of the stomach in one case of removal of metastatic ovarian tumors, but it is not known how long the patient was free from recurrence after the operation. The chances of such patients remaining free from recurrence for a long time are not excellent.

#### PROLIFERATING CYST—ADENOMATA OF THE OVARY

**DR. JOSEPH L. BAXE.** I might briefly report one case which parallels the one related by Dr. Ries, and which I have had the unfortunate privilege of observing for about eight years in relation of cause. He was operated upon by Dr. Henry Deane eight years ago. At that time he found bilateral ovarian tumors which were diagnosed microscopically by Dr. Horng as proliferating cyst adenomata of the ovary. Nodules were already extending the peritoneum. There were half a dozen of these and Dr. Deane removed each of these, found nothing clear but did not explore the upper abdominal cavity. That as eight years ago. The patient made an excellent recovery and for four years had no symptoms, then she began to have severe abdominal pain, and three years ago developed acute intestinal obstruction, for which she was laparotomized by Dr. Grossmader and the entire abdomen was found to be made of carcinomatous metastases. The omentum was identical with that which Dr. Ries speaks of, namely borborygmic infiltration, which was at least two inches thick and covered all the rest of the abdominal contents. There were scattered nodules throughout the bowel, the bowel was involved and in order to overcome the obstruction Dr. Grossmader found only two areas of bowel that were uninvolved and without knowing the exact anatomy of the two made an anastomosis. Fortunately it proved as short-circuit. The patient recovered and is still living but is sequestered to strictest,

and undoubtedly in the next month to come will succumb. At the time of her second operation thorough exploration was made, or as thorough as all the metastases and adhesions would permit. The gall bladder was found filled with uncoated stones, but the condition of the patient being as it was, the gall bladder was left untouched.

There was no conclusion reached as to the primary origin of the tumor, but an examination of pieces of this enormously infiltrated omentum revealed adenocarcinoma of this type. This case, therefore, falls in the category mentioned by Dr. Rice.

#### TUBAL ABORTION

DR. EMIL RIES: I wish to report another case because the treatment is somewhat unusual and may give rise to criticism and discussion, which I welcome most heartily.

A young woman, twenty-four years of age, had never been pregnant, came to the hospital complaining of hemorrhage. Such had been going on for three weeks. She had never missed menstruation and had always been regular. She had pain in the left side of the abdomen extending through the pelvis and into the perineum. These pains were sharp and colicky but she had neither fever nor chills. She had some general weakness and sickness. Bowel movements were regular. There were no urinary symptoms, and no respiratory or gastro-intestinal symptoms. On examination of the otherwise healthy, strong-looking young woman, I found the uterus anteverted, and bended a little more attached to the right side and anterior surface of the uterus. Such felt as hard as a fibroid. I could not tell exactly whether it was fibroid or adherent mass of pyosalpinx. As she had never had any children there was chance of there being old scarred and adherent pyosalpinx there. I did a laparotomy. The moment I opened the abdomen I saw free blood in the peritoneal cavity, the uterus and the bladder were agglutinated by adhesions which held the bladder to the fundus of the uterus. The left pyosalpinx was tied down by adhesions. The left tube as closed at its end the right is appeared a little thicker than normal, rather pink, and as I picked up the abdominal end of the tube a tubal mole dropped out of the fundus end of the tube. I saw an actual tubal abortion take place under my eye.

The question arose: When this woman had aborted from the tube is it proper treatment remove the tube? Such is getting over the propriety so that this young woman, whose left tube is useless, will never have a chance to have a baby, or is it better let that tube go through the peritoneum the same as uterus could after abortion and recover as far as possible so that the woman may have a child hereafter? Of course the question is far above the danger of hemorrhage from that tube. I know that the danger of hemorrhage from a tubal mole once it has been expelled is not great. I watched the tube a little while taking out the appendix and so rotating the gall bladder and going back to the tube to see what it was doing. It was oozing very little. The fundus and second natural and pulsation and I decided to leave the tube. So far she has made good recovery. She had a little temperature when she came in and she has a little temperature now. We know that these cases of extra-uterine pregnancy frequently have temperatures of 99° or 100° and that does not amount to anything except that there is blood in the abdominal cavity. Her highest temperature was 100° per rectum pulse 82. There were never any disquieting symptoms of internal hemorrhage. So far I should consider the case

condition perfectly safe. She lies in bed smiling and has no special complaint. The first two days she was uncomfortable but has now made good recovery.

I should like to have your opinion whether it is good thing to leave such tube with the chance of another extra-uterine pregnancy and also a chance of normal pregnancy or whether it would have been wiser to have taken out that tube to prevent further trouble.

I have a specimen showing chorionic villi, so that there is no question about the pregnancy.

#### STUDIES OF THE LYMPHATICS

DR. DANIEL N. EISENDRATH: Before showing you some kidney specimen, it might be of some interest to speak of the work we have been doing on the lymphatics. We have been studying the lymphatics of the ureter. My assistant, Miss Burn, has been injecting the lymphatics of the intestine and lymphatics of the anterior wall of the stomach, especially those near the pylorus ending in the glands, and the technique that was used is that which is the most popular to-day, namely the Gerota method of injecting a solution of Prussian blue. In connection with work on the kidney the operation of nephrotomy has been almost superseded by pyelotomy and taking out the stone from the posterior aspect through the pelvis of the kidney. In the early stages of development of that operation it was not considered necessary to remember that there was more than one type of pelvis and that was the one we have been taught in our anatomies that the kidney simply had practically one type, namely the ampullar type which consisted of a large ampulla from which the various calices came off the primary and secondary calices. As the operations continued to develop in number it was found there were other types of pelvis which were considered and these have been the subject of considerable study.

We will have studied this summer about 200 pairs of kidneys and our results so far show that about 60 per cent of the kidneys contain the type of pelvis which is known as the ampullar type seen in this specimen that about 15 per cent contain the type of pelvis in which the ureter divides almost immediately without a pelvis proper into what is known as bifid, and a third type where the ureter divides almost immediately into three. I have no specimen illustrating the third type but we have beautiful samples of some dissections which were made of the different types and also specimens showing the anatomy of pyelotomy.

#### COLLAGEN INJECTIONS

Dr. Ries has a letter to present to you briefly the work we have been doing on the in-

difficult and tedious. So it happened that an apparently innocent looking strand of peritoneal adhesions high up on the tumor upon cutting proved to contain a loop of intestine. A hurried end-to-end anastomosis was made and after the abdomen appeared clean I proceeded to perform more carefully I believe, that this saved the patient. Although there was good deal of hemorrhage and the patient's pulse was very high the first twenty-four hours, she really made an uninterrupted recovery and I present enjoys perfect health. Unfortunately the ketones were not allowed to remain with this unique pathological specimen.

#### MALIGNANT TUMORS OF THE OVARY

DR. EMIL RIES: Some time ago I demonstrated to the society a specimen that had been obtained from a patient of mine and, at the same time, discussed the question involved in the case, the origin of bilateral malignant tumors of the ovary, and referred to the limited number of cases reported in the literature which demonstrated fairly clearly that all of these cases, if carefully examined, proved to be metastatic, not primary. At the present time whenever we find a bilateral malignant tumor of the ovary our diagnosis is not complete unless we have excluded the presence of a malignant primary tumor either in the intestinal tract or in the gall-bladder.

The patient, whose specimen I wish to demonstrate to you, is a woman, fifty-seven years of age, who, as such for several months, with loss of flesh, some stomach disturbance, lack of appetite, and gradual swelling of the abdomen and legs. The abdomen became so filled with fluid that her physician tapped her some three weeks before she came under my observation and removed considerable amount of fluid. The fluid was serous-mucinous and came in the quantity of some quarts. After the tapping the physician, as able to feel tumor in the region of the umbilicus, although he was not sure of its nature. I did not see the patient until the fluid had reaccumulated, and the tumor back he had been able to palpate out in the region of the umbilicus, as then not palpable on account of the quantity of fluid which, as we can prevent. On vaginal examination I could feel a tumor on either side of the uterus and diagnosed from their hardness from the age of the patient, from the symptoms and from the fluid in the abdomen that they were malignant tumors of the ovary and also made the diagnosis that they must be secondary to something else. As these tumors compressed the rectum, and as it is possible that I might be able to remove the metastatic tumors of the ovary as well as the tumor of the intestinal tract if such ones were present, I undertook the operation with the intention of removing both. On opening the abdomen I had the escape of considerable amount of fluid again. I then immediately saw the tumor which the doctor had palpated in the region of the umbilicus. It was tumor of the omentum. The whole omentum was changed into boards-like mass, so that there was no healthy omentum to be seen. This mass was attached to the transverse colon and kept the transverse colon perfectly rigid. In the pelvis are the two ovarian tumors as diagnosed. The small intestine showed no tumors. The gall-bladder was free. On the lower convolutions of the stomach attached to the liver by adhesions, as hard tumor nodules

evidently malignant. In the presence of the tumor of the omentum it was hardly out of the question to do medical operation. It was a question whether it was wise to leave the ovarian tumors alone, but as the tumors had developed between the uterus and rectum and compressed the rectum, I considered it wise to remove the ovarian tumors to give the patient chance to have regular action of the bowels. I did that particularly because in similar case some years ago in which we found the ovarian tumors inoperable, the woman ultimately died from complete compression of the rectum with feces. In this case I removed the two ovarian tumors without any difficulty and the woman so far has made an easy recovery. The fluid is already reaccumulating.

Microscopic examination of the tumors removed shows that they are distinctly of a type which does not belong to the ovary. They are distinctly adenocarcinomatous, such as we would expect to find in the stomach or intestine, the cells showed a secretion of mucus as in adenocarcinoma of the stomach or intestine.

The case is interesting as confirming again the fact that these bilateral malignant tumors of the ovary are practically always secondary to some primary tumor in another location, and that it is not sufficient to try and remove these tumors, but we should try to remove the primary tumor also if it is possible to do so. Amann of Munich was able to do resection of the stomach in one case of removal of metastatic ovarian tumors, but it is not known how long the patient was free from recurrence after the operation. The chances of such patients remaining free from recurrence for a long time are not excellent.

#### PROLIFERATING CYST—ADENOMATA OF THE OVARY

DR. JOSEPH L. BARR: I might briefly report one case back parallel to the one related by Dr. Ries, and which I had the unfortunate privilege of observing for about eight years in relation of mine. He was operated upon by Dr. Henry Bangs eight years ago. At that time he found bilateral ovarian tumors which were diagnosed microscopically by Dr. Horng as proliferating cyst adenomas of the ovary. Nodules were already present along the peritoneum. There were half a dozen of these, and Dr. Bangs removed each of them, found each one else but did not explore the upper abdominal cavity. That eight years ago. The patient made an unusual recovery and for four years had no symptoms, then she began to have upper abdominal pain, and three years ago developed acute intestinal obstruction, for which she was hyperemicized by Dr. Graessfelder, and the entire abdomen as found to be mass of carcinoma tissue nodules. The omentum as identical with that which Dr. Ries speaks of, namely, boards-like induration, which was at least 1 1/2 inches thick and covered all the rest of the abdominal contents. There were scattered nodules throughout the bowel, the bowel was unrelaxed and in order overcome the obstruction Dr. Graessfelder found only two areas of bowel that were unobstructed and without knowing the exact anatomy of the two made an anastomosis. Intestinally it served as short-circuit. The patient recovered and is still living, but is connected to skeleton,

malignant—not that there is never a mistake, but if we can decide at the time of the operation that the tumor is benign and save the breast, take out the tumor or save the muscles, or if we can decide that the tumor which seems possibly benign is malignant and judge of the early radical operation, we have done a splendid thing for the patient. We have had cases both ways that we thought from an examination of the breast the tumor was malignant, have told the patient that in all probability the breast would have to be amputated, and we would take this means of finding out and find upon examination it was a perfectly benign tumor and vice versa. I have never yet had it happen after deciding that a tumor was benign and had removed the tumor and left the breast, that on further study of the tumor it was malignant. I recall one case not many months ago in which the pathologist came to the conclusion that he could not state whether the tumor was benign or malignant. He said that while he could find no areas that were distinctly malignant, yet he was very suspicious in the tissue he had at his disposal there was beginning to be a change into malignancy. In that case, when we cut into the growth which lacked definite limitations or borders, I decided clinically that it ought to come out, and further study of this tumor proved it to be malignant. The glands in the axilla were involved.

Those who know Dr. Ries respect his judgment in pathology but I must say I would remove some of these breasts upon less suspicion than is shown in some of the slides.

I recall one case we operated upon in which the woman had had her breast removed on the other side—the right side. Then a tumor developed in the left breast which was movable. Clinically from the feel of the tumor it seemed benign but from the standpoint of having the breast removed on the other side we were suspicious of its being malignant. Microscopic examination of the tumor we removed showed it to be a fibroma intracanalicular, as shown here. It was typical specimen and the breast was left, greatly to the satisfaction of the patient.

While the radical removal of a breast is not an operation that has any considerable mortality there are reasons why a patient does not like to have a radical operation. There are physical reasons why a patient is not so good an individual afterwards because a radical operation means the removal of muscles that make the arm less useful for manual labor but that is no reason why a carcinoma should not be removed.

We see in the literature statements to the

effect that the tumor should be watched carefully to see whether it develops elements of malignancy. There is such a tendency for breast tumors to become malignant that that form of treatment of watching and waiting is unjustifiable in the presence of a tumor of the breast. We do not wait for them to develop malignancy. We want to get at the tumor before it becomes malignant, if possible and this method gives us an opportunity to get hold of the tumor without waiting to see if it is going to develop malignancy and yet not remove useful structures, and we believe it is a great improvement to the waiting and watching treatment of these cases.

Dr. JONES. In the last year or two I have noticed that not only in epithelial tumors of the breast, but also in papillomata of the bladder and in papillary cystadenomata of the ovary where we have anywhere a hollow gland, with epithelium proliferating into the gland, it seems to be the first stage of malignancy. Gynecological specialists, who formerly looked upon papilloma of the bladder as benign simply because the epithelium did not penetrate the basement membrane are now looking upon such a tumor as malignant because ultimately these tumors do become malignant, and it seems to me the sections shown here to-night with the epithelium filling up these glands were rather suspicious, to say the least.

Dr. EMIL RIES (closing). In answer to the last point raised about these adenomas, I will say they are the most difficult to classify strictly one way or the other because they are the ones most frequently associated with distinct malignant changes. There are several papers concerned with that particular diagnosis, one from von Euseberg's clinic which gives most beautiful pictures that might be considered copies of these sections but they came to the conclusion that as long as the wall is not involved we have no right to call them malignant.

One of the specimens I showed you is from a young woman on whom I operated twelve years ago. She came to me because of the discharge of blood from her nipple, which greatly annoyed her because it came through her dress and showed on the outside. I removed only the breast. I saw her a few months ago and she was perfectly well. There is no sign of recurrence.

I showed you another specimen where the papillomatous mass filled the milk-channels. This woman was operated five or six years ago and is free from recurrence. I have shown you a case where the woman had a carcinoma of the uterus, the uterus was removed, and she is free

jection of collargol. As you know collargol was first suggested by Welch in 1906 injecting it through the ureter up into the pelvis of the kidney taking an X-ray and thus getting an outline of the pelvis of the kidney. The method has been gradually discredited, and unjustly so, owing to the number of deaths that have occurred or the ill results following the injection. There has been sudden death within five or ten minutes or an hour after the injection in several instances, especially in the cases of Smith, of Cincinnati and even in others where the patients did not die until about a week later. It has been difficult to explain a number of these cases. Several experimenters have tried by injecting collargol directly into the ureter to study its effect upon the kidney and they have found in certain conditions there would be a typical wedge-shaped infarct produced in the kidney which a number of my specimens will show. Unfortunately no one took into consideration in any of the experimental work the question of the relation of the amount of collargol which was injected to the pressure and at the suggestion of one of my friends, Dr Greensfelder we began our work of simply injecting the collargol without any effort to study the effects of pressure, and we obtained typical collargol infarcts, as you will see from the specimens which I pass around which have their bases toward the cortex and apex towards the papilla and which in some cases goes on to necrosis. That is the serious consequence.

The first specimens which I shall pass around are those where we injected kidneys without any effort to study the amount of pressure. We soon found that it was impossible to deduce any conclusions from such an irregular study so that we began to use a manometer and we are doing that work still. First of all, we estimated exactly the capacity of a dog's kidney which is  $2\frac{1}{2}$  ccm. The moment you inject more than  $2\frac{1}{2}$  ccm. which will run under a pressure of 35 mm. of mercury which is equal to 3 feet elevation above a table, you begin to get trouble because one of two things happens either the collargol will escape into the peripelvic tissue, as happens frequently it cannot force its way beyond the pelvis of the kidney but forces its way either into the peripelvic or perirenal tissue, as these specimens show, or the more serious consequences happen, namely we understand why these people die after the injection of collargol. We find that as soon as we exceed by quantity any of 4 mm. which will more than comfortably distend the pelvis of the kidney the moment we exceed under pressure 80 to 90 mm. of mercury trouble

begins. In other words, if the collargol does not escape into the perirenal tissue, the other day consequence happens—it gets into the circulation, forces its way into the interstitial connective tissue, and gets into the renal vein. In the specimen I pass around, the dog died within five minutes after we injected 80 ccm. of collargol under 100 mm. of pressure into its right kidney. It was not an anesthetic death, because there was little anesthetic given during the operation. The moment the dog died an autopsy was done. We found the vena cava filled with collargol. We found the right side of the heart filled with collargol, and you will see in this specimen that the right side of the heart is tremendously filled with collargol, the left side less so.

Here is a beautiful example of collargol embolism. If you take these two lungs, one of which represents the milder stage—one of the animals died in about thirty minutes after the injection of collargol,—you will see black spots showing the milder degree of collargol embolism. In the next specimen the entire lung is perfectly black with collargol and from the microscopic specimens every little capillary of the lung is filled with collargol. We obtained the same results not only by the collargol in the lungs, but collargol infarcts in the liver corresponding with the infarcts described by Rest as found in his specimens. There were collargol infarcts both in the liver and spleen. This specimen shows beautifully collargol in the veins of the liver. You can do no harm by these injections as long as you do not exceed a reasonable degree of pressure and do not exceed the capacity of the renal pelvis. In other words, in order to do safe pyelography we dare not use any force. As long as we do not use too much force and too large a quantity of collargol we will not have trouble, but the moment we exceed that we will

Dr Emil Ries read a paper entitled *Diagnosis of Tumors of the Breast during Operation*, which was illustrated by numerous stereopticon slides.

#### DISCUSSION

Dr CHANNING W. BARRETT. Those who have had the opportunity of listening to the paper of Dr. Ries and witnessing the demonstrations feel well repaid for being here. He has covered the ground on the question of whether a tumor is benign or malignant so well that there is very little left to be said. I feel there is no part of one's work that is more satisfactory in the end, come than a microscopic demon at the time of operation upon a tumor whether it is benign or

# Clinical Congress of Surgeons of North America

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FIFTH ANNUAL SESSION

LONDON ENGLAND

WEEK OF JULY 27 1914

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Samaritan Free Hospital for Women—DR. F. J.  
MCCANN  
Royal National Ophthalmic—MR. A. H. TURNER  
Central London Ophthalmic—MR. STEPHEN  
MAYNOR

Gynecology by Doederlein and Kronig. In spite of the truly graphic descriptions by Reed, it can not be gainsaid that the beginner whose actual experience is as yet limited would profit vastly from more accurate illustrations.

**THIS** textbook has grown out of the author's "Diagnosis of Diseases of Women" which was the first and for a time the only American work on gynecological diagnosis. The good features which distinguished this book reappear in the large volume before us. The author recognizes the principle that the correct interpretation of symptoms rests primarily upon thorough knowledge of the morbid anatomy and he therefore pays particular attention to a detailed description of both the macroscopic and microscopic structure of the affected parts.

The general practitioner will welcome the chapters on conservative methods of treatment such as douches, baths, massage, diet, and tampons, for these non-operative measures have not received their due share of consideration in textbooks and in practice which they rightly deserve. In these days when gynecology is in danger of becoming merely surgical specialty the gynecologist, too, should make himself conversant with every non-operative measure which may promise relief. For this reason, perhaps, might have been given a little more space than the author reserves for them. For prolapse of the uterus when operation is deemed inadvisable the author recommends the old cup and stem pessary attached to an abdominal support. The reviewer would venture the opinion that the Menges and Locklein pessaries have rendered the McIntosh pessary obsolete.

In the matter on hygienic dress, and exercise, the author shows himself in line with the best teachings of the day. This chapter short as it is, will be of greatest value to the practitioner in that it will enable him to forestall disease by his wise counsel.

In the subject matter itself we find here and there cause for dissenting views. In discussing cervical lacerations (p. 15) the author claims that this relatively slight local injury may cause widespread perturbation of nerve function. Such a doctrine is not altogether in accord with modern thought. Among the operations for cancer of the cervix when the Schauta method of extended vaginal hysterectomy is not mentioned and the description of the Wertheim method is too short to be of practical value. The same is true of ureteral catheterization by means of the Nitze cystoscope, a procedure which would demand more than one or two of

descriptive text. Referring to spinal anesthesia (p. 890) the author completely omits giving credit to Bier and recommends the old technique of Tuffier which has long since been improved in almost every detail. Among the various methods of cesarean section, neither the high incision of Davis nor the extra and transperitoneal procedures of the German writers are considered.

While the author has not fully succeeded in grasping the actual status of each subject as it existed in gynecologic science at the moment of writing, yet he reveals himself as so strong a personality and his book contains so many unusual and attractive features that this work should find a place in the library of every practitioner who attempts the treatment of diseases of women.

The chapter on post-operative complications and their treatment will doubtless be consulted with advantage by many and help in numerous instances to turn the scale in favor of the patient.

This review cannot be closed without a word of appreciation of the chapter on diseases of the urinary system. This field is no longer on the borderline between gynecology and surgery. The genital and urinary systems in the female are so closely allied both topographically and developmentally that familiarity with this topic has become an absolute necessity to the modern gynecologist.

May we not ask the author to eliminate biblical references in future editions of this book? If, for example, he believes that pregnancy may occur after the menopause (p. 68) he should be able to cite more recent cases than that of Abraham who was one hundred years of age and Sarah ninety when their child was born.

I work of this size debatable points are bound to occur. One can, for instance hardly agree with the author when he discusses, in less than four lines, the subject of spinal anesthesia notwithstanding the fact that this method has become the sovereign one in gynecologic operations in Germany and France and is just now having vogue in this country. But such points of difference are easily overlooked in weighing the value of the entire book, which has been written in so concise a manner and which so clearly portrays the author's qualifications as an excellent teacher that we do not hesitate to warmly recommend this textbook to the profession.

**THIS** volume is the continuation of the complete review of the subjects arranged alphabetically. The third volume contains the same or has a consideration of the various topics which characterized the two former volumes and is worthy of the same commendation.

# CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

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## THE CLINICAL CONGRESS OF SURGEONS

THE 1914 session of the Clinical Congress bids fair to be a great success, not only in point of scientific interest, but in the number who expect to attend the meeting.

The complete clinical program given on the following pages is comprehensive in its scope and cannot help but be attractive to those interested in surgery and the surgical specialties. This program, however, is only an outline of what the work will be. The daily program as it will be bulletined at headquarters each day will be more extensive and will give in detail the nature of the operative work and demonstrations.

Among the clinicians you will note the names of the leading surgeons of London, and among the institutions where the clinics and demonstrations are to be held, the principal hospitals and medical schools of the great city. The entire field of surgery is covered and one will find enough actual surgical work along any one line to keep him busy from morning to night each day of the session. In addition to clinics in operative surgery a large number of special demonstrations in radiology, experimental surgery, surgical pathology, etc. will be provided.

The plan of the evening sessions is unique and has proved in the recent meetings of the Congress one of the most attractive features of the organization. By referring to the detailed program on the following pages, it will be noted that the orators have been selected because of their special

fitness to present the last word on their respective subjects. It is not a program of volunteers, but a selection of those best qualified from the clinics of Great Britain, Europe and America. The men who discuss the papers have also been carefully selected because of their special fitness to speak on the subject assigned.

The rules of the Congress limit the reading of the papers to twenty-five minutes and each discussion to ten minutes. As there are no voluntary papers or discussions, the sessions are definite, to the point, and are not allowed to drag on to the point of tediousness.

For the benefit of those who may have overlooked the matter published during the past few months, we reprint herewith the detailed arrangements which have been made with regard to registration, headquarters, daily bulletins of clinics, etc., together with the clinical and evening programs corrected to date.

### HEADQUARTERS OF THE CONGRESS

The headquarters of the Congress are ideal. The embarkment suites of entertainment halls of the capacious Hotels Cecil and Savoy, located side by side in the hospital center of London, have been secured for the registration rooms, exhibition halls and evening meeting rooms. These great hostilities, with their combined capacity for more than fifteen hundred guests, are located



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The meetings will begin at 8 30 o'clock and adjourn not later than 11.45. The principal papers are to be read by visiting surgeons and a time limit of twenty five minutes has been fixed for each address. The papers are to be discussed by London surgeons and the discussions limited to ten minutes each.

#### ENTERTAINMENTS

It has been the policy of the Clinical Congress of Surgeons to discourage large entertainments of a social nature. The time is so carefully arranged and occupied by scientific meetings and clinics that there is no proper time for social functions. Then, too, the Congress of necessity must always be held in large cities where there is much of general interest in the way of theaters, museums, and art galleries, which affords entertainment for those seeking occasional recreation and for the accompanying ladies. This plan has worked out so well in other cities where sessions of the Congress have been held that it is hoped the same policy will be observed in London. It must be remembered that the burden to the profession or a municipality of entertaining large medical societies in recent years has become so great as to be almost prohibitive.

#### RAILING ACCOMMODATIONS

It is urged that accommodations for going and return passage be arranged for at the earliest possible date. The Transportation Manager of the Congress is in a position to obtain excellent accommodations on any of the leading steamship lines at rates that will suit the financial requirements of the inquirer. Reservations can be made on some of the late sailing fast steamers, whereby a surgeon may attend the Congress and return with the loss of but three weeks' time.

#### REDUCED RATES

A special reduction of 25 per cent to members of the Clinical Congress and their immediate families has been made by the different steamship lines as given below.

*Cunard Line* eastbound on or after July 7 westbound on or before August 27

*Allen Line* eastbound on or after July 2 westbound on or before August 28

*The International Mercantile Marine Lines* which include the *White Star Atlantic T* on *port American Line* and *Red Star Line*, eastbound on or after July 2 westbound on or before August 28

*The Hamburg-American Line* eastbound on or after July 7th westbound on or before August

15 except that the reduction will be available on the steamship *Amerika* sailing on August 22 for Boston.

*The North German Lloyd Line* eastbound on or after July 7th westbound on or before August 27

*The Holland American Line* eastbound on or after July 14 westbound on or before August 28

*The Canadian Northern* eastbound on or after July 14th westbound on or before August 28

*The Leyland Line* eastbound on or after July 4 westbound on or before August 28

A complete list of the eastbound steamers on which the reduction is obtainable is given on page xiv of the advertising section of this Journal.

It is important to note that the minimum first class rate must be adhered to under no circumstances can the fare be less than the minimum rate.

For further information, address either the General Secretary 30 N. Michigan Avenue, Chicago, or the Transportation Manager Mr J. P. McCann, Marlborough Building, New York City.

#### LONDON HOTELS

In addition to the Cecil and Savoy the Headquarters of the Congress, there are a large number of hotels centrally located which have agreed to make advance reservations for members of the Congress. These hotels include among others, the Carlton, Metropole, Grand, Victoria, Grosvenor, Imperial, Russell, Waldorf Ritz, Piccadilly, Great Central, First Avenue, Rachehen, St. Ermina, Hans Crescent, Windsor Langham, Royal Palace, and De Keyers Royal.

While there will be no difficulty in securing hotel accommodations somewhere in London during the week of the Congress, it is advisable to make reservations early.

#### SURGEONS' INTERNATIONAL GOLF MATCH

NOTICE.—It is proposed to arrange a golf match between teams representing London surgeons and North American surgeons, on one afternoon during the week of the Congress. Arrangements will be made for the matches to take place at seven or eight of the numerous courses around London. In this way it will be possible to arrange for 50 or 100 couples to take part without crowding, as the number of couples playing on the same course will be limited to ten or twelve.

Members of the Congress who desire to play are requested to send their names and handicap to Mr Herbert Pateman, at the London Office of the Congress, 2 Wimpole St. W.

within a stone's throw of many of the other famous hotels of London.

Surgeons on reaching London should proceed at once to the headquarters at the Hotel Cecil, register and receive their membership cards and tickets which will admit them to the evening meetings and to the clinics. The registration fee is five dollars, or twenty-one shillings.

Those who prefer to do so may register in advance and receive their credentials, by sending the amount of the fee to the General Secretary, Clinical Congress of Surgeons, 30 North Michigan Avenue, Chicago, before July 1st, after which time remittance should be sent to the London office of the Congress, No. 1 Wimpole St., London W., England.

#### BULLETIN ROOMS

The bulletin rooms for the Congress will be at the Hotel Cecil.

The program for Monday, July 17th, will be bulletined on Saturday afternoon, July 15th, two days before the opening of the Congress. In the afternoon of each day of the session a complete accurate program of the clinics and demonstrations to be given on the succeeding day will be posted on the bulletin board. The registration and bulletin rooms will also be open on Sunday, July 16th, for the accommodation of early arrivals.

#### MEMBERSHIP IN THE CONGRESS

Any physician or surgeon legally qualified to practice surgery in his community may become member of the Clinical Congress by registering at any annual meeting and paying the registration fee.

Automatically the subscribers to *SURGERY GYNECOLOGY AND OBSTETRICS*, the official journal of the Congress, will receive invitations without request. Other members of the profession who desire to attend will receive formal invitations upon request to Franklin H. Martin, 31 D. General Secretary, 30 North Michigan Avenue, Chicago or to No. 1 Wimpole St., London W.

#### REGISTRATION FEE—ADVANCE REGISTRATION

A registration fee is required of each surgeon upon registration, at which time a membership card will be issued as stated above. North American surgeons who wish credentials to enable them to secure reduced steamship rates may register in advance and receive certificate of membership. The registration fee of five dollars should be sent to the General Secretary, 30 N. Michigan Avenue, Chicago, before July 1st, or to No. 1 Wimpole St., London, W., after July 1st.

Unlike conditions prevailing in most medical

societies, where annual dues are paid by each member without regard to his attendance at any meeting of the society, the payment of a registration fee is required of a member of the Congress only when he is in attendance at an annual session.

The purpose of this fee is to provide funds to meet the expenses of preparing for and conducting the annual meeting. In order that no financial burden other than the registration fee may be imposed upon the members of the profession in the city entertaining the Congress, judging from past experience, the amount received from such fees will be barely sufficient for the purpose, so that payment of the fee is expected of all who attend the clinics or evening sessions.

#### RESERVED SEATS FOR CLINICS

Reserved tickets for all clinics and demonstrations, numbered and couponed, correspond as to the capacity of each operating room, will be issued, and may be secured at headquarters.

A tentative program will be furnished to all prospective attendants of the Congress who apply for the same. The program will be printed in *SURGERY GYNECOLOGY AND OBSTETRICS*, the official journal of the Congress, and in other medical journals. From this program one may make his selection of the clinics he wishes to attend and send a written request for reserved tickets to Mr. A. D. Ballou, General Manager, No. 1 Wimpole St., London, W., stating definitely for just what clinics the tickets are desired. These tickets will be retained at headquarters up to a certain fixed time (to be determined and announced later) in the name of the applicant, and will be assigned as nearly as possible in order of application. That the applicants may not be disappointed if the tickets for their first choice are exhausted, several selections should be made.

#### MEMBERSHIP CARDS

Each surgeon who desires to attend the clinics and evening sessions must register at headquarters and secure a membership card. Admission to all clinics and evening sessions will be limited strictly to members of the Congress upon presentation of such membership cards.

#### THE EVENING MEETINGS

Evening meetings will be held simultaneously in two halls: the general surgical program to be given in the Grand Hall of the Hotel Cecil and the program of the specialties, Surgery of the Eye, Ear, Nose and Throat, and Oral Surgery in the Ballroom of the Hotel Savoy.

The meetings will begin at 8.30 o'clock and adjourn not later than 11.45. The principal papers are to be read by visiting surgeons and a time limit of twenty-five minutes has been fixed for each address. The papers are to be discussed by London surgeons and the discussions limited to ten minutes each.

#### ENTERTAINMENTS

It has been the policy of the Clinical Congress of Surgeons to discourage large entertainments of a social nature. The time is so carefully arranged and occupied by scientific meetings and clinics that there is no proper time for social functions. Then, too, the Congress of necessity must always be held in large cities where there is much of general interest in the way of theaters, museums, and art galleries, which affords entertainment for those seeking occasional recreation and for the accompanying ladies. This plan has worked out so well in other cities where sessions of the Congress have been held that it is hoped the same policy will be observed in London. It must be remembered that the burden to the profession or a municipality of entertaining large medical societies in recent years has become so great as to be almost prohibitive.

#### SAILING ACCOMMODATIONS

It is urged that accommodations for going and return passage be arranged for at the earliest possible date. The Transportation Manager of the Congress is in a position to obtain excellent accommodations on any of the leading steamship lines at rates that will suit the financial requirements of the inquirer. Reservations can be made on some of the late sailing fast steamers, whereby a surgeon may attend the Congress and return with the loss of but three weeks' time.

#### REDUCED RATES

A special reduction of 25 per cent to members of the Clinical Congress and their immediate families has been made by the different steamship lines as given below.

*Cunard Line* eastbound on or after July 7 westbound on or before August 27.

*Alcoa Line* eastbound on or after July 2 westbound on or before August 28.

*The International Mercantile Marine Lines* which include the *White Star Atlantic Transport American Line* and *Red Star Line*, eastbound on or after July 2 westbound on or before August 28.

*The Hamburg American Line* eastbound on or after July 7th westbound on or before August

25 except that the reduction will be available on the steamship *Amerika* sailing on August 22 for Boston.

*The North German Lloyd Line* eastbound on or after July 7th westbound on or before August 27.

*The Holland American Line* eastbound on or after July 24, westbound on or before August 28.

*The Canadian Northern* eastbound on or after July 14th westbound on or before August 28.

*The Leyland Line* eastbound on or after July 4 westbound, on or before August 28.

A complete list of the eastbound steamers on which the reduction is obtainable is given on page xiv of the advertising section of this Journal.

It is important to note that the minimum first class rate must be adhered to under no circumstances can the fare be less than the minimum rate.

For further information, address either the General Secretary 30 N. Michigan Avenue, Chicago, or the Transportation Manager Mr. J. P. McCann, Marbridge Building, New York City.

#### LONDON HOTELS

In addition to the Cecil and Savoy the Headquarters of the Congress, there are a large number of hotels centrally located which have agreed to make advance reservations for members of the Congress. These hotels include, among others, the Carlton, Metropole, Grand, Victoria, Grosvenor, Imperial, Russell, Waldorf, Ritz, Piccadilly, Great Central, First Avenue, Richelieu, St. Ermins, Hans Crescent, Windsor, Langham, Royal Palace, and De Keyers Royal.

While there will be no difficulty in securing hotel accommodations somewhere in London during the week of the Congress, it is advisable to make reservations early.

#### SURGEONS' INTERNATIONAL GOLF MATCH

NOTICE.—It is proposed to arrange a golf match between teams representing London surgeons and North American surgeons, on one afternoon during the week of the Congress. Arrangements will be made for the matches to take place at seven or eight of the numerous courses around London. In this way it will be possible to arrange for 50 or 100 couples to take part without crowding, as the number of couples playing on the same course will be limited to ten or twelve.

Members of the Congress who desire to play are requested to send their names and handicap to Mr. Herbert Paterson, at the London Office of the Congress, 1 Wimpole St. W.

## PROGRAM OF EVENING SESSIONS

## GENERAL SURGICAL DIVISION

*Presidential Meeting Monday July 27th in the Grand Hall Hotel Cecil*

Formal Opening

Address of Welcome by SIR RICHARD J. GOULEE, Honorary Chairman of the London Committee.

Welcome to American Surgeons, by the HONORABLE WALTER HUGH PAGE, American Ambassador

GEORGE EDWIN BROWNE, M. D. New York City Address of retiring president

Inauguration of PRESIDENT JOHN B. MURPHY and VICE PRESIDENT GEORGE E. ARMSTRONG

PROFESSOR A. VON ECKELHARDT, Vienna The Choice of the Operative Method for Ulcer of the Stomach

Discussion by SIR WATSON CHESTNUT and MR. JAMES SHERREN

JOHN B. MURPHY, M. D. Chicago Presidential Address: Arthrodesis and Bone Transplantation; Its Limitations and Technique

*Tuesday July 28th in the Grand Hall Hotel Cecil*

PROFESSOR TUFFIER, Paris Transplantation of Ovaries.

Discussion by Sir John Bland-Sutton.

HENRY JELLEY, F. R. C. P. Dublin The Use of the Levator-Ani Muscle and the Utero-Sacral Ligament in Prolapse Treatment

Discussion by Dr. Herbert Spencer London

ROBERT JONES, F. R. C. S., Liverpool Certain Derangements of the Knee Joint and Their Treatment

Discussion by Mr. A. H. Talbot and Mr. Robert Milne

*Wednesday July 29th in the Grand Hall Hotel Cecil*

GEORGE E. ARMSTRONG, M. D. Montreal Typhoid Perforation.

Discussion by SIR ARTHUR BOWLY, F. R. C. S. London

CHARLES H. MATS, M. D. Rochester Primary and Late Results of Operations for Emphysematic Gaster or Hyperthyroidism

Discussion by JAMES REEVE, F. R. C. S.

*Thursday July 30th in the Grand Hall Hotel Cecil*

PROFESSOR DOCTOR KÄHN, Freiburg, Germany The Principles of Non-Operative Treatment of Carcinoma.

JAMES F. PRYCE, M. D. Galesburg, Illinois The Treatment of Inoperable Carcinoma of the Uterus by the Application of Heat.

THOMAS WILSON, F. R. C. S. Birmingham Cancer of the Uterus

Discussion by THOMAS WATTS ENCK, F. R. C. S. W. W. H. TATE, M. R. C. S. W. E. MYLES, F. R. C. S. London, and Dr. JOSEPH COLT BLOOMGOOD, Baltimore

*Friday July 31st, in the Grand Hall Hotel Cecil*

E. WYLLIS ANDREWS, M. D. Chicago Care of Hernia by Tissue Inlaying or Fascial Implantation.

Discussion by LAWRENCE HUGH McGLAVIE, F. R. C. S.

SIR WILLIAM OWEN, Bart., Oxford Intestinal Stasis

SIR BENJAMIN MORTIMER, Leeds Intestinal Stasis.

JOSEPH COLT BLOOMGOOD, M. D. Baltimore Surgery of Intestinal Stasis.

Discussion by SIR ARTHUR LANE, Bart.

PROGRAM OF EVENING SESSIONS—*Continued*

## DIVISION OF SURGICAL SPECIALTIES

*Tuesday July 28th in the Ballroom of the Hotel Savoy*

- PROFESSOR E. SCHMIDTKELOW Copenhagen, Denmark The Results of Operations (Laryngostomy) for Intrinsic Cancer of the Larynx.  
 Discussion by Sir S. CLAIR THOMSON London
- DR. J. M. WERT, Berlin, Germany The Internal Surgery of the Lachrymal Apparatus, after an Experience with over 225 Operations.  
 Discussion by Dr. D. R. PATTERSON of Cardiff
- CHARLES W. RICHARDSON M. D. Washington D. C. Congenital Atresia of the Post Nasal Office

*Wednesday July 29th in the Ballroom of the Hotel Savoy*

- DR. A. LOGAN TURNER, Edinburgh The Application of Skiagraphy to the Mastoid Region and Its Use in the Detection of Disease.  
 Discussion by Mr. SMURTY SCOTT London
- M. FLORE E. JONES, Liverpool, England Some Considerations which Determine the Extent of an Operation in Septic Invasion of the Lateral Sinus.  
 Discussion by Mr. HUNTER TOL, London
- F. H. WESTMACOTT F. R. C. S. Manchester Internal Ophthalmoplegia of Ocular Origin.  
 Discussion by Dr. McKENZIE, M. D. F. R. C. S. London

*Thursday July 30 in the Ballroom of Hotel Savoy*

- Symposium on Surgery of the Cleft Palate. (Papers to be limited to fifteen minutes each)  
 ROBERT W. MURRAY F. R. C. S. Liverpool  
 F. W. GUYNER, M. D. F. R. C. S. Bradford.  
 JONA. ULSTON, Copenhagen, Denmark  
 TRUMAN W. BROWNE, M. D. Chicago  
 GEORGE V. I. BROWN, M. D. Milwaukee, Wisconsin.  
 JOSEPH R. EASTMAN, M. D. Indianapolis, Indiana  
 Dr. THEO. KÄRIGEN, Berlin
- Discussions limited to two minutes each by Sir WILLIAM ARBUTHNOT LAM, London, EDWARD OWEN, M. B. F. R. C. S. London, JAMES BERRY, M. B. F. R. C. S. London Professor KATH, London, T. Percy LEE, M. B. F. R. C. S. London, and Dr. EDWARD B. Judd, Rochester Minnesota

*Friday July 31st in the Ballroom of the Hotel Savoy*

- R. H. ELLIOTT, Lt. Col., I. M. S. Madras, India The Sclero-Corneal Trephining Operation for Glaucoma.  
 Discussed by Mr. THOMAS COLLINGS
- M. F. RICHARDSON CHENE, Bristol Operative Procedure for Strabismus.  
 Discussion by Mr. N. BRIDGES HARRIS, London.
- DR. JOHN B. STOKES, Dublin The Operation for Senile Cataract  
 Discussion by Mr. HUGHES SPENCE

## PRELIMINARY CLINICAL PROGRAM

## SURGICAL CLINICS

Monday July 27th

MR. DARCY POWER—St. Bartholomew Hospital—<sup>10</sup>  
 MR. H. J. WARING—St. Bartholomew's Hospital—<sup>10</sup>  
 MR. C. GORDON WATSON—St. Bartholomew's Hospital—<sup>10</sup>  
 MR. HAROLD W. WILSON—St. Bartholomew's Hospital—<sup>10</sup>  
 MR. R. C. ILMISLIE—St. Bartholomew's Hospital—<sup>10</sup>  
 MR. H. B. ROBINSON—St. Thomas' Hospital—<sup>10</sup>  
 MR. LUTHERBET WALLACE—St. Thomas' Hospital—<sup>10</sup>  
 MR. J. E. ADAMS—St. Thomas' Hospital—<sup>10</sup>  
 MR. L. ROCK CARLING—Westminster Hospital—<sup>10</sup>  
 MR. A. H. TUBBY—Westminster Hospital—<sup>10</sup>  
 MR. ARBUTHNOT LANE—Guy's Hospital—<sup>10</sup>  
 MR. L. A. DUNN—Guy's Hospital—<sup>10</sup>  
 MR. F. J. STEWARD—Guy's Hospital—<sup>10</sup>  
 MR. C. H. FAGGE—Guy's Hospital—<sup>10</sup>  
 MR. R. P. ROWLANDS—Guy's Hospital—<sup>10</sup>  
 MR. P. TURNER—Guy's Hospital—<sup>10</sup>  
 MR. E. C. HUGHES—Guy's Hospital—<sup>10</sup>  
 MR. R. DAVIES-COLLEY—Guy's Hospital—<sup>10</sup>  
 MR. A. R. THOMSON—Guy's Hospital—<sup>10</sup>  
 MR. H. S. PENDLEBURY—St. George's Hospital—<sup>10</sup>  
 MR. T. CRISP ENGLISH—St. George's Hospital—<sup>10</sup>  
 SIR FREDERIC EVE—London Hospital—<sup>10</sup>  
 MR. HUGH LETT—London Hospital—<sup>10</sup>  
 SIR A. PEARCE GOULD and MR. W. S. HANDLEY—Middlesex Hospital—<sup>10</sup>  
 MR. A. E. BARKER—University College Hospital—<sup>10</sup>  
 MR. BILTON FOLLARD—University College Hospital—<sup>10</sup>  
 MR. V. Z. COPE—St. Mary's Hospital—<sup>10</sup>  
 MR. WATSON CHEYNE—King's College Hospital—<sup>10</sup>  
 MR. A. CARLESS—King's College Hospital—<sup>10</sup>  
 MR. T. P. LEGO—King's College Hospital—<sup>10</sup>  
 MR. A. EDMUNDS—King's College Hospital—<sup>10</sup>  
 MR. H. F. WATERHOUSE—Charing Cross Hospital—<sup>10</sup>  
 MR. JAMES BERRY—Royal Free Hospital—<sup>10</sup>  
 MR. W. ASHDOWNE—Metropolitan Hospital—<sup>10</sup>  
 MR. J. CUNNING and MR. CLIL ROWNTREE—Cancer Hospital—<sup>10</sup>  
 MR. E. M. CORNER—Hospital for Sick Children—<sup>10</sup>  
 MR. TYRRELL GRAY—Hospital for Sick Children—<sup>10</sup>  
 MR. D. ARMOUR—West London Hospital—<sup>10</sup>  
 MR. E. GILLESPIE—Prince of Wales General Hospital—<sup>10</sup>  
 MR. LOCKHART MUMFERY—St. Mark's Hospital—<sup>10</sup>  
 MISS CHADBURN—New Hospital for Women—<sup>10</sup>

Tuesday July 28th

MR. W. MCADAM ECCLES—St. Bartholomew's Hospital—<sup>10</sup>  
 MR. R. COZENS BAILEY—St. Bartholomew's Hospital—<sup>10</sup>  
 MR. R. C. ILMISLIE—St. Bartholomew's Hospital—<sup>10</sup>  
 MR. G. H. MAKINS—St. Thomas' Hospital—<sup>10</sup>  
 MR. W. H. BATTLE—St. Thomas' Hospital—<sup>10</sup>  
 MR. C. A. BALLANCE—St. Thomas' Hospital—<sup>10</sup>  
 MR. H. B. ROBINSON—St. Thomas' Hospital—<sup>10</sup>  
 MR. CYRIL NITCH—St. Thomas' Hospital—<sup>10</sup>  
 MR. W. G. SPENCER—Westminster Hospital—<sup>10</sup>  
 SIR ARBUTHNOT LANE—Guy's Hospital—<sup>10</sup>  
 MR. L. A. DUNN—Guy's Hospital—<sup>10</sup>  
 MR. F. J. STEWARD—Guy's Hospital—<sup>10</sup>  
 MR. C. H. FAGGE—Guy's Hospital—<sup>10</sup>  
 MR. R. P. ROWLANDS—Guy's Hospital—<sup>10</sup>  
 MR. P. TURNER—Guy's Hospital—<sup>10</sup>  
 MR. E. C. HUGHES—Guy's Hospital—<sup>10</sup>  
 MR. W. H. TRETHERWYN—Guy's Hospital—<sup>10</sup>  
 MR. G. R. TURNER—St. George's Hospital—<sup>10</sup>  
 MR. J. JAFFREY—St. George's Hospital—<sup>10</sup>  
 MR. H. M. RIGBY—London Hospital—<sup>10</sup>  
 MR. JAMES SHERRY—London Hospital—<sup>10</sup>  
 MR. R. WARREN—London Hospital—<sup>10</sup>  
 MR. F. KIDD—London Hospital—<sup>10</sup>  
 MR. JOHN MURRAY and MR. ALFRED JOHNSON—Middlesex Hospital—<sup>10</sup>  
 MR. T. H. KELLOCK and MR. GORDON TAYLOR—Middlesex Hospital—<sup>10</sup>  
 MR. RAYMOND JOHNSON—University College Hospital—<sup>10</sup>  
 MR. WILFRED TROTTER—University College Hospital—<sup>10</sup>  
 MR. WARREN LOW—St. Mary's Hospital—<sup>10</sup>  
 MR. F. F. BURGHARD—King's College Hospital—<sup>10</sup>  
 MR. G. L. CHEATLE—King's College Hospital—<sup>10</sup>  
 MR. STANLEY BOYD—Charing Cross Hospital—<sup>10</sup>  
 MR. W. H. EVANS—Royal Free Hospital—<sup>10</sup>  
 MR. H. CURTIS—Metropolitan Hospital—<sup>10</sup>  
 MR. JOCELYN SWAN and MR. H. W. WILSON—Cancer Hospital—<sup>10</sup>  
 SIR ARBUTHNOT LANE—Hospital for Sick Children—<sup>10</sup>  
 MR. GEORGE WAUGH—Hospital for Sick Children—<sup>10</sup>  
 MR. A. BALDWIN—West London Hospital—<sup>10</sup>  
 MR. G. L. ADDISON—West London Hospital—<sup>10</sup>  
 SIR VICTOR HORSLEY—National Hospital—<sup>10</sup>  
 Surgery of the Head and Nervous System  
 MR. H. W. CARSON—Prince of Wales General Hospital—<sup>10</sup>  
 MISS ALDRICH BLAKE—New Hospital for Women—<sup>10</sup>

# CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

Wednesday July 30th

SIR ANTHONY BOWLBY—St. Bartholomew's Hospital—<sup>30</sup>  
 MR. H. J. WARING—St. Bartholomew's Hospital—<sup>30</sup>  
 MR. J. GIRLING BALL—St. Bartholomew's Hospital—<sup>30</sup>  
 MR. O. H. MAKINS—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. W. H. BATTLE—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. C. A. BALLANCE—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. H. B. ROBINSON—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. E. M. CORNER—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. PERCY SARGENT—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. C. STONHAM—Westminster Hospital—<sup>to 3</sup>  
 MR. J. M. O. SWAINSON—Westminster Hospital—<sup>to 3</sup>  
 MR. IVOR BACK—St. George's Hospital—<sup>to 3</sup>  
 MR. C. H. FRANKAU—St. George's Hospital—<sup>to 3</sup>  
 MR. J. HUTCHINSON—London Hospital—<sup>to 3</sup>  
 MR. R. MILNF—London Hospital—<sup>to 3</sup>  
 MR. A. J. WALTON—London Hospital—<sup>to 3</sup>  
 SIR JOHN BLAND-SUTTON and MR. GORDON TAYLOR—Middlesex Hospital—<sup>to 3</sup>  
 MR. RAYMOND JOHNSON—University College Hospital—<sup>to 3</sup>  
 MR. MAYNARD SMITH—St. Mary's—<sup>to 3</sup>  
 SIR WATSON CHEYNE—King's College Hospital—<sup>to 3</sup>  
 MR. A. CARLESS—King's College Hospital—<sup>to 3</sup>  
 MR. T. P. LEGG—King's College Hospital—<sup>to 3</sup>  
 MR. CHARLES GIBBS—Charing Cross Hospital—<sup>to 3</sup>  
 MR. JAMES BERRY—Royal Free Hospital—<sup>to 3</sup>  
 MR. J. CUNNING—Royal Free Hospital—<sup>to 3</sup>  
 MR. P. L. DANIEL—Metropolitan Hospital—<sup>to 3</sup>  
 MR. C. RYALL—Cancer Hospital—<sup>to 3</sup>  
 MR. T. H. KELLOCK—Hospital for Sick Children—<sup>to 3</sup>  
 MR. L. E. BARRINGTON-WARD—Hospital for Sick Children—<sup>to 3</sup>  
 MR. J. S. PARDOE—West London—<sup>to 3</sup>  
 MR. P. J. FREYER—St. Peter's—<sup>to 3</sup>  
 MR. J. W. THOMSON WALKER—St. Peter's Hospital—<sup>to 3</sup>  
 MR. J. HOWELL EVANS—Prince of Wales General Hospital—<sup>to 3</sup>  
 MR. JACKSON CLARKE—Hampstead General Hospital—<sup>to 3</sup>  
 MR. GEORGE WAUGH—Hampstead General Hospital—<sup>to 3</sup>  
 MR. SIDNEY BOYD—Hampstead General Hospital—<sup>to 3</sup>  
 MR. CHAD WOODWARD—Hampstead General Hospital—<sup>to 3</sup>  
 MR. ARLETT BALDWIN—St. Mark's Hospital—<sup>to 3</sup>  
 MISS GARRETT ANDERSON and MISS BOLTON—New Hospital for Women—<sup>to 3</sup>

Thursday July 30th

MR. D'ARCY POWER—St. Bartholomew's Hospital—<sup>to 3</sup>  
 MR. R. COZENS BAILEY—St. Bartholomew's Hospital—<sup>to 3</sup>

MR. L. BATHE RAWLING—St. Bartholomew's Hospital—<sup>to 3</sup>  
 MR. G. E. GASK—St. Bartholomew's Hospital—<sup>to 3</sup>  
 MR. H. B. ROBINSON—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. CUTHBERT WALLACE—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. E. M. CORNER—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. J. E. ADAMS—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. W. TURNER—Westminster Hospital—<sup>to 3</sup>  
 SIR ARBUTHNOT LANE—Guy's Hospital—<sup>to 3</sup>  
 MR. F. J. STEWARD—Guy's Hospital—<sup>to 3</sup>  
 MR. C. H. FAGGE—Guy's Hospital—<sup>to 3</sup>  
 MR. P. TURNER—Guy's Hospital—<sup>to 3</sup>  
 MR. E. C. HUGHES—Guy's Hospital—<sup>to 3</sup>  
 MR. R. DAVIES-COLLEY—Guy's Hospital—<sup>to 3</sup>  
 MR. G. R. TURNER—St. George's Hospital—<sup>to 3</sup>  
 MR. T. CRIST ENGLISH—St. George's Hospital—<sup>to 3</sup>  
 MR. W. FEDDE FEDDEN—St. George's Hospital—<sup>to 3</sup>  
 MR. IVOR BACK—St. George's Hospital—<sup>to 3</sup>  
 MR. C. H. FRANKAU—St. George's Hospital—<sup>to 3</sup>  
 MR. T. H. OPENSHEAW—London Hospital—<sup>to 3</sup>  
 MR. RUSSELL HOWARD—London Hospital—<sup>to 3</sup>  
 MR. F. KIDD—London Hospital—<sup>to 3</sup>  
 SIR A. PEARCE GOULD and MR. W. S. HANDLEY—Middlesex Hospital—<sup>to 3</sup>  
 MR. A. E. BARKER—University College Hospital—<sup>to 3</sup>  
 MR. MORRISTON DAVIES—University College Hospital—<sup>to 3</sup>  
 MR. W. H. CLAYTON-GREEN—St. Mary's Hospital—<sup>to 3</sup>  
 MR. F. F. BURGHARD—King's College Hospital—<sup>to 3</sup>  
 MR. A. EDMUNDS—King's College Hospital—<sup>to 3</sup>  
 MR. H. F. WATERHOUSE—Charing Cross Hospital—<sup>to 3</sup>  
 MR. W. S. FENWICK—Charing Cross Hospital—<sup>to 3</sup>  
 MR. H. A. T. FAIRBANK—Charing Cross Hospital—<sup>to 3</sup>  
 MR. C. PANNETT—Royal Free Hospital—<sup>to 3</sup>  
 MR. W. E. MILES—Cancer Hospital—<sup>to 3</sup>  
 MR. H. A. T. FAIRBANK—Hospital for Sick Children—<sup>to 3</sup>  
 MR. O. L. ADDISON—Hospital for Sick Children—<sup>to 3</sup>  
 MR. H. W. CARSON—Prince of Wales General Hospital—<sup>to 3</sup>  
 MR. GORDON WATSON—St. Mark Hospital—<sup>to 3</sup>  
 MISS CHADBURN—New Hospital for Women—<sup>to 3</sup>

Friday July 31st

SIR ANTHONY BOWLBY—St. Bartholomew's Hospital—<sup>to 3</sup>  
 MR. W. MACADAM ECCLES—St. Bartholomew's Hospital—<sup>to 3</sup>  
 MR. G. H. MAKINS—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. W. H. BATTLE—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. C. A. BALLANCE—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. CYRIL NITCH—St. Thomas' Hospital—<sup>to 3</sup>  
 MR. ARTHUR EVANS—Westminster Hospital—<sup>to 3</sup>  
 SIR ARBUTHNOT LANE—Guy's Hospital—<sup>to 3</sup>  
 MR. L. A. DUNN—Guy's Hospital—<sup>to 3</sup>  
 MR. F. J. STEWARD—Guy's Hospital—<sup>to 3</sup>

MR. C. H. FAGGE—Guy's Hospital—  
 MR. R. F. ROWLANDS—Guy's Hospital—  
 MR. P. TURNER—Guy's Hospital—2.  
 MR. E. C. HUGHES—Guy's Hospital—  
 MR. W. H. TRETHOWAN—Guy's Hospital—  
 MR. F. JAFFREY—St. George's Hospital—30 to 4.  
 MR. H. S. PENDLEBURY—St. George's Hospital—1 to 4.  
 SIR FREDERIC EVE—London Hospital—  
 MR. H. M. RIGBY—London Hospital—9.  
 MR. JAMES SHERRIN—London Hospital—2.  
 MR. HUGH LETT—London Hospital—1.  
 MR. JOHN MURRAY and MR. ALFRED JOHNSON—Middlesex Hospital—1 to 10.  
 MR. T. H. KELLOCK and MR. GORDON TAYLOR—Middlesex Hospital—30.  
 MR. DILTON POLLARD—University College Hospital—2.  
 MR. WILFRED TROTTER—University College Hospital—9.  
 MR. D. C. L. FITZWILLIAMS—St. Mary's Hospital—9.  
 SIR WATSON CHEYNE—King's College Hospital—  
 MR. A. CARLESS—King's College Hospital—9 to 30.  
 MR. G. L. CHEATLE—King's College Hospital—  
 MR. T. P. LEGG—King's College Hospital—9 to 30.  
 MR. A. EDMUNDS—King's College Hospital—  
 MR. STANLEY BOYD—Charing Cross Hospital—1 to 5.  
 MR. F. L. DANIELS—Charing Cross Hospital—9 to 10.  
 MR. W. H. FLANS—Royal Free Hospital—1 to 1.  
 MR. H. CURTIS—Metropolitan Hospital—  
 SIR ARBUTHNOT LANE—Hospital for Sick Children—9 to 10.  
 MR. O. L. ADDISON—Hospital for Sick Children—10 to 1.  
 MR. H. S. SOUTTAR—West London Hospital—9.  
 MR. F. SAINTFORD EDWARDS—St. Peter's Hospital—  
 MR. G. B. PARDOE—St. Peter's Hospital—  
 MR. J. SWIFT JOLY—St. Peter's Hospital—  
 MR. J. HOWELL EVANS—Prince of Wales General Hospital—1 to 30 to 4 to 30.

MR. J. W. THOMSON WALKER—Hampstead General Hospital—2.  
 MR. GEORGE WAUGH—Hampstead General Hospital—10.  
 MR. SIDNEY BOYD—Hampstead General Hospital—10.  
 MR. CHAD WOODWARD—Hampstead General Hospital—10.  
 MISS ALDRICH-BLAKE—New Hospital for Women—8.  
 MR. DONALD ARMOUR—National Hospital—1.  
 Surgery of the Head and Nervous System.  
 MR. PERCY SARGENT—National Hospital—10.  
 Surgery of the Head and Nervous System.

### Saturday August 1st

MR. W. FEDDE FEDDEN—St. George's Hospital—10 to 4.  
 MR. IVOR BACCH—St. George's Hospital—30 to 4.  
 SIR JOHN BLAND-SUTTON and MR. GORDON TAYLOR—Middlesex Hospital—30.  
 MR. MORRISTON DAVIES—University College Hospital—9.  
 MR. F. F. BURGHARD—King's College Hospital—9 to 30.  
 MR. G. L. CHEATLE—King's College Hospital—  
 MR. CHARLES GIBBS—Charing Cross Hospital—9 to 10.  
 MR. H. S. CLOGG—Charing Cross Hospital—1 to 3.  
 MR. C. A. JOLL—Royal Free Hospital—1 to 3.  
 MR. P. L. DANIEL—Metropolitan Hospital—10.  
 MR. H. A. T. FAIRBANK—Hospital for Sick Children—9 to 10.  
 MR. H. TYRELL GRAY—West London Hospital—  
 MR. E. GILLESPIE—Prince of Wales General Hospital—9 to 30 to 30.

### Days and Hours to be Announced

MR. MAYNARD SMITH—St. Mary's Hospital.

## GYNECOLOGICAL CLINICS

### Monday July 27th

DR. W. & A. GRIFFITH—St. Bartholomew's Hospital—  
 DR. A. F. STARR and DR. G. F. DAPWELL SMITH—St. George's Hospital—1 to 1.  
 DR. DRUMMOND MAXWELL—London Hospital—2.  
 DR. JOHN PHILLIPS—King's College Hospital—  
 DR. A. E. GILES—Chelsea Hospital for Women—10 to 3.  
 DR. S. DODD—Chelsea Hospital for Women—30.  
 DR. C. H. FORD—Samaritan Free Hospital for Women—  
 DR. J. A. WILLETT—Samaritan Free Hospital for Women—9.  
 DR. DAWKELL SMITH—Samaritan Free Hospital for Women—9.

### Tuesday July 28th

DR. J. BARRIS—St. Bartholomew's Hospital—30.  
 DR. WALTER TATE—St. Thomas Hospital—10 to 1.  
 MR. H. CHAPPEL—Guy's Hospital—9.  
 DR. COMINS BRIDLEY and DR. VICTOR BONNIA—Middlesex Hospital—30.  
 DR. HERBERT SPENCER—University College Hospital—  
 DR. T. O. STEVENS—St. Mary's—9 (Obstetric Surgery).  
 DR. HUGH PLAYFAIR—King's College Hospital—9.  
 DR. T. W. EDEN and DR. C. H. LOCKVER—Charing Cross Hospital—1 to 3.  
 MRS. VAUGHAN SAWYER—Royal Free Hospital—1 to 5.

DR. W. H. FENTON — Chelsea Hospital for Women — 9.30.  
 DR. VICTOR BONNEY — Chelsea Hospital for Women — 9.30.  
 DR. J. B. BANISTER — Chelsea Hospital for Women — 9.30.  
 DR. DRUMMOND ROBINSON — West London Hospital — 9.  
 MR. J. D. MALCOLM — Samaritan Free Hospital for Women — 9.  
 DR. F. J. McCANN — Samaritan Free Hospital for Women — 9.

*Wednesday July 29th*

DR. W. S. A. GRIFFITH — St. Bartholomew's Hospital — 9.  
 MR. G. B. SMITH — Guy's Hospital — 9.  
 DR. F. J. McCANN — Samaritan Free Hospital for Women — 9.  
 DR. C. LOCKYER — Samaritan Free Hospital for Women — 9.

*Thursday July 30th*

DR. H. WILLIAMSON — St. Bartholomew's Hospital — 9.30.  
 DR. WALTER TATE — St. Thomas' Hospital — 9 to 10.  
 MR. H. CHAPPEL — Guy's Hospital — 9.  
 DR. DRUMMOND MAXWELL — London Hospital — 9.30.  
 DR. COMYNS BERKELEY and DR. VICTOR BONNEY — Middlesex Hospital — 10.  
 DR. GEORGE BLACKER — University College Hospital — 9.  
 DR. JOHN PHILLIPS — King's College Hospital — 9.  
 DR. H. G. PLAYFAIR and DR. EARDLEY HOLLAND — Metropolitan Hospital — 9.  
 DR. T. W. EDEN — Chelsea Hospital for Women — 9.30.  
 DR. F. L. PRORIS — Chelsea Hospital for Women — 9.30.  
 DR. ARTHUR GILES and DR. J. B. BANISTER — Prince of Wales General Hospital — 10 to 4.30.  
 MR. C. H. ROBERTS — Samaritan Free Hospital for Women — 9.

DR. F. J. McCANN — Samaritan Free Hospital for Women — 9.  
 DR. CLIFFORD WHITE — Samaritan Free Hospital for Women — 9.

*Friday July 31st*

DR. W. S. A. GRIFFITH — St. Bartholomew's Hospital — 9.  
 DR. G. H. D. ROBINSON and DR. S. DODD — Westminster Hospital — 9.  
 MR. G. B. SMITH — Guy's Hospital — 9.  
 DR. A. F. STABB and DR. G. F. DARWELL SMITH — St. George's Hospital — 9.30 to 10.  
 DR. HUGH PLAYFAIR — King's College Hospital — 9.  
 DR. T. W. EDEN and DR. C. H. LOCKYER — Charing Cross Hospital — 10 to 11.  
 MRS. WILLEY — Royal Free Hospital — 9 to 10.  
 DR. COMYNS BERKELEY — Chelsea Hospital for Women — 9.30.  
 DR. H. J. F. SIMSON — West London Hospital — 9.  
 DR. ARTHUR GILES and DR. J. B. BANISTER — Prince of Wales General Hospital — 9.30 to 10.30.  
 MR. J. D. MALCOLM — Samaritan Free Hospital for Women — 9.  
 DR. C. LOCKYER — Samaritan Free Hospital for Women — 9.  
 DR. D. W. ROSE — Samaritan Free Hospital for Women — 9.  
 DR. H. GILLIATT — Samaritan Free Hospital for Women — 9.

*Saturday August 1st*

DR. HERBERT SPENCER — University College Hospital — 9.

*Days and Hours to be Announced*

DR. JOHN FAIRBAIRN and DR. J. P. HEDLEY — St. Thomas' Hospital.  
 DR. W. J. GOW — St. Mary's Hospital.

## OPHTHALMOLOGICAL CLINICS

*Monday July 27th*

MR. H. L. LASON — Guy Hospital — 9.  
 MR. L. V. CARGILL — King's College Hospital — 9.  
 MR. H. W. LYLE — King's College Hospital — 9.  
 MR. A. F. DORRELL — Prince of Wales General Hospital — 9 to 10.30.  
 MR. TREACHER COLLINS — Royal London Ophthalmic Hospital — 9.  
 Mr. C. A. WORTH — Royal London Ophthalmic Hospital — 9.  
 MR. M. L. HEPBURN — Royal London Ophthalmic Hospital — 10.  
 MR. A. C. HUDSON — Royal London Ophthalmic Hospital — 10.

*Tuesday July 28th*

MR. W. H. JESSOP — St. Bartholomew's Hospital — 9.  
 MR. G. HARTIDGE and MR. G. T. B. JAMES — Westminster Hospital — 9.  
 MR. A. W. ORMOND — Guy's Hospital — 9.  
 MR. M. L. HEPBURN — Royal Free Hospital — 9 to 10.  
 MR. E. T. COLLINS — Charing Cross Hospital — 9 to 10.  
 MR. HOLMES SPICER — Royal London Ophthalmic Hospital — 9.  
 MR. PERCY FLEMING — Royal London Ophthalmic Hospital — 9.  
 MR. J. H. FISHER — Royal London Ophthalmic Hospital — 10.

MR. C. D. MARSHALL—Royal London Ophthalmic Hospital—o.

MR. M. L. HEPBURN—Royal London Ophthalmic Hospital—10.  
MR. A. C. HUDSON—Royal London Ophthalmic Hospital—10.

*Wednesday July 29th*

MR. H. BARR GRIMSDALE and MR. G. T. BROOKS-BANK JAMES—St. George's Hospital—9 to 4.  
MR. W. T. LISTER—London Hospital—J.  
MR. PERCY FLEMING—University College Hospital—9.  
MR. E. T. COLLINS—Charing Cross Hospital—9 to 2.  
MR. R. P. BROOKS—Prince of Wales General Hospital—2.30 to 4.30.  
MR. J. B. LAWFORD—Royal London Ophthalmic Hospital—  
MR. ARNOLD LAWSON—Royal London Ophthalmic Hospital—10.  
MR. J. H. PARSONS—Royal London Ophthalmic Hospital—1.  
MR. GEORGE COATS—Royal London Ophthalmic Hospital—10.

*Thursday July 30th*

MR. W. HOLMES SPICER—St. Bartholomew's Hospital—J.  
MR. H. L. EASON—Guy's Hospital—  
MR. A. B. ROXBURGH—London Hospital—  
MR. L. V. CARGILL—King's College Hospital—  
MR. H. W. LYLE—King's College Hospital—  
MR. H. PERCY DURN—West London Hospital—  
MR. TREACHER COLLINS—Royal London Ophthalmic Hospital—10.  
MR. C. A. WORTH—Royal London Ophthalmic Hospital—10.

*Friday July 31st*  
MR. A. W. ORMOND—Guy's Hospital—  
MR. HOLMES SPICER—Royal London Ophthalmic Hospital—  
MR. PERCY FLEMING—Royal London Ophthalmic Hospital—10.  
MR. J. H. FISHER—Royal London Ophthalmic Hospital—  
MR. C. D. MARSHALL—Royal London Ophthalmic Hospital—

*Saturday August 1st*

MR. H. BARR GRIMSDALE and MR. G. T. BROOKS-BANK JAMES—St. George's Hospital—9.15 to 11.  
MR. HERBERT PARSONS—University College Hospital—9.  
MR. J. B. LAWFORD—Royal Ophthalmic Hospital—10.  
MR. ARNOLD LAWSON—Royal London Ophthalmic Hospital—10.  
MR. J. H. PARSONS—Royal London Ophthalmic Hospital—10.  
MR. GEORGE COATS—Royal London Ophthalmic Hospital—

*Days and Hours to be Announced*

MR. J. B. LAWFORD and MR. J. H. FISHER—St. Thomas' Hospital.  
MR. ARNOLD LAWSON—Middlesex Hospital.  
MR. L. J. PATON—St. Mary's Hospital.

## OTOLOGICAL LARYNGOLOGICAL, AND RHINOLOGICAL CLINICS

*Monday July 27th*

MR. W. D. HARMER—St. Bartholomew's Hospital—J.  
MR. C. E. WEST—St. Bartholomew's Hospital—J.  
MR. W. G. HOWARTH—St. Thomas' Hospital—9 to 10.  
MR. HERBERT TILLY—University College Hospital—  
MR. WILLIAM HILL—St. Mary's—9.  
MR. ARTHUR CHEATLE—King's College Hospital—  
MR. WILLIAM HILL—St. Mary's Hospital—  
MR. GAY FRENCH—Royal Free Hospital—9 to 12.  
MR. R. S. COCKE—Royal Ear Hospital—  
MR. W. STUART-LOW—Central London Throat and Ear Hospital—9 to 10.30.

*Tuesday July 28th*

MR. J. A. ROSE—St. Bartholomew's Hospital—4.5.  
MR. W. M. MOLLISON—Guy's Hospital—9.

MR. H. S. BARWELL—St. George's—9.15 to 10.  
MR. ST. CLAIR THOMSON—King's College Hospital—  
MR. E. W. WAGGETT and MR. E. D. DAVIS—Charing Cross Hospital—9 to 10.  
MR. H. D. GILLIES—Prince of Wales General Hospital—9.30 to 10.30.  
MR. JEFFERSON FAULDER—Hospital for Diseases of the Throat—  
MR. R. S. COCKE—Royal Ear Hospital—  
MR. H. A. KISCH—Royal Ear Hospital—  
DR. PETER H. AMERCRONBIE—Central London Throat and Ear Hospital—9.  
DR. ANDREW WYLIE—Central London Throat and Ear Hospital—10.  
MR. HAROLD KISCH—Central London Throat and Ear Hospital—9.

*Wednesday July 29th*

MR. W. D. HARMER—St. Bartholomew's Hospital—4.5.  
MR. C. E. WEST—St. Bartholomew's Hospital—9.

MR. H. J. MARRIAGE—St. Thomas Hospital—9 to 10  
 MR. T. B. LAYTON—Guy's Hospital—9  
 MR. J. A. J. DUNN—Guy Hospital—9  
 MR. H. S. BARWELL—St. George Hospital—9  
 MR. SOMERVILLE HASTINGS—Mid-Sex Hospital—9 to 10  
 MR. S. COMBET HETT—University College Hospital—9  
 MR. ARTHUR CHEATLE—King College Hospital—9  
 MR. C. V. HOPE—King's College Hospital—9  
 MR. H. J. DAVIS—West London Hospital—9  
 MR. C. H. DADGEROW—Hospital for Diseases of the Throat—9  
 MR. P. M. VARNLEY—Royal Ear Hospital—9  
 MR. CHURCHILL NOURSE—Central London Throat and Ear Hospital—9  
 DR. PETER ABERCROMBIE—Central London Throat and Ear Hospital—9 to 10  
 DR. DAN M. KENZIE—Central London Throat and Ear Hospital—9

## Thursday July 30th

MR. SYDNEY SCOTT—St. Bartholomew Hospital—9  
 MR. W. G. HOWARTH—St. Thomas Hospital—9 to 10  
 MR. H. J. MARRIAGE—St. Thomas Hospital—9  
 MR. P. R. W. de SANTI—Westminster Hospital—9  
 MR. HUNTER TODD—London Hospital—9 to 10  
 MR. SOMERVILLE HASTINGS—Mid-Sex Hospital—9  
 MR. C. J. CHAMBERLAIN—St. Mary's—9

SIR ST. CLAIR THOMSON—King's College Hospital—9  
 MR. ARTHUR CHEATLE—King College Hospital—9  
 MR. GEORGE WAUGH—Hospital for Sick Children—9 to 10  
 MR. CHARLES PARKER—Hospital for Diseases of the Throat—9  
 MR. FITZGERALD POWELL—Hospital for Diseases of the Throat—9  
 MR. RICHARD LAKE—Royal Ear Hospital—9  
 DR. ANDREW WYLIE—Central London Throat and Ear Hospital—9  
 DR. JAMES ATKINSON—Central London Throat and Ear Hospital—9 to 10  
 DR. DAN M. KENZIE—Central London Throat and Ear Hospital—9 to 10

## Friday July 31st

MR. W. D. HARMER—St. Bartholomew Hospital—9  
 MR. M. MOLLISON—Guy's Hospital—9  
 MR. HERBERT TILLY—University College Hospital—9  
 SIR ST. CLAIR THOMSON—King College Hospital—9  
 MR. E. B. WAGGETT and MR. E. D. DAVIS—Charing Cross Hospital—9 to 10  
 MR. J. W. BOND—Hospital for Diseases of the Throat—9  
 MR. FRANK ROSE—Hospital for Diseases of the Throat—9  
 MR. F. M. YEAL—Royal Ear Hospital—9  
 DR. J. A. FITZGERALD—Royal Ear Hospital—9  
 MR. CHURCHILL NOURSE—Central London Throat and Ear Hospital—9 to 10  
 DR. JAMES ATKINSON—Central London Throat and Ear Hospital—9

## SPECIAL DEMONSTRATIONS

## Monday July 1st

DR. A. D. RILEY, DR. W. R. BRISTOW and DR. CLAUDE GOLDBERGER—St. Thomas Hospital—9 to 10  
 DR. W. S. JEN and DR. C. A. SIMMONS—Guy's Hospital—9 to 10  
 MR. W. I. MILLS—Cancer Hospital—9 to 10  
 DR. R. HUTCHINSON—Hospital for Sick Children—9 to 10  
 MR. H. A. T. PARKER—Hospital for Sick Children—9 to 10  
 MEMBERS OF THE STAFF—Central London Throat and Ear Hospital—9 to 10

## Tuesday July 2nd

DR. A. I. KID and DR. W. R. BRISTOW and DR. CLAUDE GOLDBERGER—St. Thomas Hospital—9 to 10  
 MR. W. S. JEN and DR. C. A. SIMMONS—Guy's Hospital—9 to 10

MR. H. T. TIMBERG—St. Thomas Hospital—9 to 10  
 DR. ROBERT KNOWN—King George Hospital—9 to 10  
 DR. W. DEBES EMERY—King George Hospital—9 to 10  
 MR. W. H. EVANS—Royal Free Hospital—9 to 10  
 MR. C. KYLE—Cancer Hospital—9 to 10  
 DR. A. F. VOLZKE—Hospital for Sick Children—9 to 10  
 DR. VICTOR THORNTON—Hospital for Sick Children—9 to 10  
 MR. E. J. BARKINGTON—Hospital for Sick Children—9 to 10  
 MR. CRAMPTON ANDERSON—St. Mark Hospital—9 to 10  
 MEMBERS OF THE STAFF—Central London Throat and Ear Hospital—9 to 10  
 MEMBERS OF THE STAFF—Central London Throat and Ear Hospital—9 to 10

*Wednesday July 29th*

- DR. A. D. REID DR. W. R. BRISTOW and DR. CLAUDE GOULDSBROUGH — St. Thomas' Hospital — 9 to 10 X-ray and Electro-Therapeutics
- MIR. S. G. SHATTOCK — St. Thomas' Hospital — 9 to 10 Pathological Laboratory
- SIR ARBUTHNOT LANE, and MR. C. H. FAGGE — Guy's Hospital — Cases of Intestinal Stenosis and Fractures.
- MIR. T. B. LAYTON — Guy's Hospital — Examination of cases by means of Lillman's laryngoscope Tests of the vestibular nerve in cases of disease of the ear and brain. Cases of paralysis of the larynx and allied conditions
- MIR. J. A. EDMOND — Guy's Hospital — 1.30 Cases of Syphilis of the nose and throat, treated by methods used in the British Army
- MIR. JAMES BERRY — Royal Free Hospital — 9 to 11.30 Surgical Cases
- MIR. GAY FRINCH — Royal Free Hospital — 10 to 11 Throat, Nose and Ear Cases
- MIR. JOCELYN SWAN — Cancer Hospital — 4.30 Tumors of the Kidneys
- MIR. O. L. ADDISON — Hospital for Sick Children — 4 to 5 Cases of Syphilitic Otitis in Children
- MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 3.00 Out Patient Clinic

*Thursday July 30th*

- DR. R. S. TREVOR — St. George's Hospital — 10 to 11 Pathological Specimens in the Museum
- MIR. J. CUNNING — Royal Free Hospital — 10 to 11 Surgical Cases
- MRS. VAUGHAN SAWYER — Royal Free Hospital — 10 to 11 Gynecological Cases
- MIR. J. CUNNING — Cancer Hospital — 4.30 Cancer of the Breast
- DR. G. F. STILL — Hospital for Sick Children — 10 to 11 Congenital Pyloric Stenosis
- MEMBERS OF THE STAFF — Demonstrations in the Out Patient Department — St. Peter's Hospital —
- MIR. CUTHBERT WALLACE — St. Thomas' Hospital — 4 Demonstration of Prostatic Specimens
- MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 3.00 Out Patient Clinic

*Friday July 31st*

- DR. W. S. FOX and DR. G. A. SIMMONS — St. George's Hospital — 10 to 11 X-ray and Electro-Therapeutics Department
- DR. W. D'ESTES EMERY — King's College Hospital — 9 to 10 Pathological Laboratory
- MIR. C. A. PANNETT — Royal Free Hospital — 10 to 11 Surgical Cases
- DR. E. U. WILLIAMS — Royal Free Hospital — 10 to 11 X-Ray Department
- DR. F. E. BATTEN — Hospital for Sick Children — 10 to 11 The Use of Cefaloid Spinals in the Treatment of Acute and Chronic Infantile Paralysis
- MIR. GEORGE WAUGH — Hospital for Sick Children — 4 to 5 End-Results of Acute Otitis Media
- MIR. L. E. C. NORBURY — St. Mark's Hospital — 3.00
- MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 3 to 4 Special demonstrations
- MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 5 Out Patient Clinic

*Saturday August 1st*

- DR. ROBERT KNOX — King's College Hospital — Radiography
- DR. SILK and MR. F. F. BURGHARD with the assistance of the architect and consulting engineer, will show visitors over the new building and explain the plans. — King's College Hospital —
- MRS. WILLEY — Royal Free Hospital — 9 to 11 Gynecological Cases
- MIR. T. H. KELLOCK — Hospital for Sick Children — 9.30 to 11.00 End Results of Operative Procedures
- MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 3.00 Out Patient Clinic

*Day and Hours to be Announced*

- DR. GILBERT SCOTT — London Hospital — The X-ray in Treatment and Diagnosis
- DR. J. H. SIQUEIRA — London Hospital — Cases of Skin Diseases of Surgical Interest

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## FRACTURES NEAR JOINTS

By HARRY M. SHERMAN, M. D.

## FRACTURES INTO JOINTS

By HARRY M. SHERMAN, M. D., F. A. C. S. and DUDLEY TAIT, M. D., F. A. C. S. SAN FRANCISCO

### PART I.—FRACTURES NEAR JOINTS

THE occurrence of a fracture in one of the long bones near a joint develops mechanical conditions different from those present when the fracture is in or near the middle of the bone, and the fracture near a joint is specialized by being in a region where both the anatomy and physiology are relatively complex. The short fragment and the mobile joint are elements difficult to manage in the treatment in order to attain accurate alignment of fragments and retain normal joint mobility in the result. A study of these difficulties is always in order and it is the more important because some of them are new or at any rate, new to us, though they have, in point of fact, existed from the beginning of our present anatomical epoch. The discovery of new elements in the condition-complex of an old and customary fracture necessitates modifications in the plans of treatment which we have inherited from our surgical forebears, or the elaboration of wholly new methods, and everywhere surgeons are working out variations in old or devising new technique founded upon the clearer concepts of lesions and the newer surgical methods of to-day. These variations and innovations have the same fate as those constantly occurring in nature: some are

useful and are perpetuated, others are useless and are abandoned. In studying some of the useful variants I have noticed a common element in them, seen practically in all, and have accepted it—rightly I think—as the dominant characteristic and the one which makes the method a good one and gives it reason for existence. In all there has been the selection—independently by a number of different surgeons—of a definite position for the fractured limb and in each instance and in the various joints it has been at the normal limit of motion in the direction in which motion is most difficult to regain after healing under the older classical methods. That this dominant characteristic is necessarily a position rather than a method of dressing I think I can explain by an observation I made some years ago and reported at the time. I had charge of a little boy with an open supracondylar fracture of the humerus. It was just at the time when discussion of the cause and means to prevent gunstock deformity after this fracture were rife, and I took the opportunity of studying the parts, by finger and eye, through the wound. I was impressed by noting that in all the manipulations the small fragment representing the humeral condyles bound by

Work done in part in the Surgical Research Laboratory of the University of California

*the forearm muscles and elbow-joint ligaments to the ulna and radius and attached in no way to the shaft of the humerus was mechanically and for purposes of therapy a part of the forearm.* Its position could be controlled or changed only by and through the forearm and every attempt to immobilize it in its proper relation to the major fragment presupposed or demanded control of the position and disposition of the forearm. What is true of one joint must be true of all when a mechanical condition common to all is under consideration, and in all instances of fractures near joints where the minor fragment is more firmly fixed by joint structures and other tissues to the segment of the limb beyond the joint than it is to the major fragment, some position of the segment of the limb or of the whole limb must be found for the proper alignment of the fragments and for their maintenance in that position. I have been so impressed by this fact that I believe it may be classed as one of the laws in the management and treatment of *juxta-articular* or *intra-articular* fractures that it is applicable and operative in several instances can be demonstrated, and that it may be found applicable and operative in others seems, to me not unreasonable.

Since the time when I studied my patient a supracondylar fracture Mr Robert Jones of Liverpool has introduced the method of treatment in which the forearm is put in a position of complete flexion on the arm as the dominant point. In this position the forearm falls into a perfectly natural relation to the arm, the lower fragment of bone is held by forearm muscles elbow joint ligaments and the interlocking of the bony parts, in a perfectly natural relation to the forearm and therefore to the arm, and the whole region is in the encompassing sling made of the muscles, fasciæ and skin on the extensor side of the joint. If proper reposition of the fragments has been attained, the single act of putting the forearm into a position of complete flexion on the arm and keeping it there accomplishes the act of redressment and maintenance of the normal relation—so that union finds restored natural alignment, a normal anatomy

But this is not all for in this particular joint the method has other advantages. Upon the removal of the dressings from an arm, fractured thus but treated in the ordinary way flexed to a right angle at the elbow, this joint is found to have but a limited range of motion. It can be flexed a little past the position of right angle flexion and extended a little beyond the same position, but it is capable of neither complete flexion nor complete extension. Of course, the range of motion at once begins to increase, especially if attempts at forcing it are *rigidly excluded* but it increases in extension far more rapidly than in flexion. The reasons are two. First The oblique line of fracture in the bone has approached much more nearly to the capsule in front than it has in the back, and reparative callus can encroach much more on the space in the flexure of the joint than it can on the extensor surface, so that the room required for the act of flexion can be filled up and flexion can be prohibited. Second In the erect position in which our waking hours are spent, the act of flexion is an active effort against the force of gravity and the gain in flexion can only be attained in this way. Gravity however is constantly aiding the act of extension and is in operation even if all the muscles of the arm are at rest. Hence it is that the individual has to approach his hand to his collar and his mouth with effort and patience. But in the arm treated in the position of complete flexion the reparative material obstacle to flexion does not exist the hand is already capable of reaching both mouth and collar and can at once begin its service again, the act of extension has much less, if any reparative material obstacle, and gravity is always in operation to help. But even with the opposition of gravity eliminated, or without its aid, the right of way for the least easily recovered motion has been assured from the beginning and other motions are readily secured so that union finds conditions all favorable to an early resumption of full function, a normal physiology.

At the other end of the humerus, the upper end, a fracture through or below the tubercles or through the anatomical neck so

disposes matters that we have to deal with a short ungraspable minor fragment, rotated outward and abducted by scapulohumeral muscles and if unimpacted wholly free from the major fragment. The major fragment may be in any indifferent position, but quite ordinarily its upper end is below and internal to the minor fragment. Recognizing the conditions special to the joint, devices have been presented for meeting them changing old time methods of treatment. Cotton records Mitteldrop's triangle the O-good and Penhallow splint and Monk's triangle, and all of these conform to this condition that the minor fragment of the humerus bound by muscle and ligament to the scapula, is for the time mechanically a part of the scapula that the major fragment, to recover control of it, must follow the minor fragment's movement to the anatomical limit of shoulder joint abduction and rotation. Even a limited experience with upper humeral fractures will teach that this is a difficult or for a long time impossible position for an arm that has been dressed in the more conventional position,—that is, by the side and rotated in with the forearm and hand across the upper belly—for if coaptation of the fractured parts has not been secured and maintained the components of the joint are already in abduction, and further motion in that direction is markedly limited so that to lift the arm from the side scapular rotation must be called into service long before it need be in normal joints. Not only is this true immediately after healing but it must remain true so long as the adduction deformity at the point of fracture persists and this will be always unless some operative correction of it be undertaken.

Since writing this part of this paper—more than two years ago—I have had to treat several fractures of the humerus at this point in which coaptation of fragments was not possible without an incision. In each of them I found no difficulty in getting anatomical alignment when dealing with the bones directly but I found more for once coaptation had been secured and the fragments pressed well together they remained thus artificially partly impacted without any internal fixation device and I could then dress

the arm in the conventional by the side position, and at the same time feel confident that full normal abduction at the shoulder joint would be easily and early a possibility. This seemingly negatives the postulate of the paper—that the limb must be in the position most difficult to attain after conventional and older plans of treatment, but it does so only by going beyond it and with full recognition of the anatomical and surgical factors present.

At the hip-joint, fractures of the femur have various values depending upon the location and direction of cleavage lines and also upon the age of the patients. From the view point I have assumed we can at once exclude impacted fractures of the femoral neck in the middle aged and old. The impaction clearly retains the femoral head as a part of the femur. In non impacted fractures at all ages the minor fragment, bound by no muscles and perhaps by but a part of the capsule to the major fragment, cannot be controlled by manipulation of the femur without taking the untorn capsule into consideration. At the same time its relation to the pelvis is equally tenuous. Ordinarily under the pull of the pelvi trochanteric muscles the major fragment will be dragged cephalad and will also by its weight, rotate outwards. It will, in these movements abduct and rotate *inwards* the minor fragment. Now this minor fragment, the head and part of the neck, comprises the essential of the femoral components of the articulation, and with it already in abduction when healing begins there is no possibility of abduction for the limb when healing has been completed certainly not if the limb has been treated in the ordinary way in the ordinary position. Often I have tested this point, and have invariably found marked limitation to abduction after well managed and well healed femoral neck fractures. The little unget-at-able piece of bone is the crux of the situation the major fragment must go to meet it, and to do that the limb must be put into abduction until the trochanter rests against the rim of the acetabulum—maximal normal abduction. In this position the untorn capsule pulls tight and embraces the broken ends of the fragments, putting them into something very

like natural alignment. Healing under this postural method binds the femoral neck in about the normal relation to the shaft and the limb capable of normal abduction an act which is, as I have said impossible if union had occurred with the minor fragment abducted and the major one adducted. I am impressed with the method though from a limited number of observations, its chief disadvantage being its restricted application to patients for those who cannot tolerate bed life cannot be treated by it but must be content with a method which treats the patient rather than the fracture. To those who are suitable it gives most excellent results by putting the limb in a position which is the normal limit of motion in the direction in which motion is most difficult to regain after treatment by the more conventional method.

While impaction of a fractured femoral neck in the old is a sacred thing not to be lightly broken up by heavy hands, the same in the young has a different value. If it persists normal abduction is for all time lost, for the minor fragment already is abducted and the major fragment adducted at the point of fracture. If under proper anesthesia, the limb is at once put into this prohibited position normal abduction, the impaction is broken and the fragments then behave as if there had been no impaction the position most difficult of attainment is secured from the beginning and the final result is anatomically and physiologically the nearest approach to the normal.

The most common fracture at the ankle joint is the one least commonly properly treated. I am sure that Pott's fracture suffers by the very reason of its commonness. We all think we can easily treat it. I am however bound to acknowledge because of the many ill-treated cases that I see that it is a wholly misconceived lesion. Few stop to think of the lesion complex which contains four distinct elements, and fewer still stop to recollect the importance of the joint and the great amount of force put upon it for an ordinary man running or jumping in a not extraordinary manner develops a force of more than 600 pounds upon the top of his astragalus. The great importance of getting

anatomical restitution is, therefore, made obvious.

I have been for many years, in a small way, a clearing house for these cases and I find the people a few months after the fracture, with a limited ankle-joint motion range which can be understood because of the ankle joint involvement. But I find them also with a pronated foot and one quite incapable of supination. Now this motion occurs not at the ankle joint but at the subastragloid joint, which is not more than secondarily implicated in the lesion but if the ankle joint is dressed in an abnormal position of pronation the normal amount of supination at the subastragloid joint cannot compensate for it least of all in such times of stress as when more than a quarter of a ton of weight is put on it. In the lesion the minor fragment, that is, the internal malleolus, is attached to the foot by the internal lateral ligaments of the ankle-joint and is wholly free from the major fragment, and it is, for all practical purposes, a part of the foot. Control of the minor fragment can only be secured by and through control of the foot. To approximate the minor to the major tibial fragment means that the foot must be dressed in a position of full normal supination. Other details such as keeping the foot in a position of work at right angles to the leg and the correction of possible luxation forward of the foot on the leg and also the correction of the widening of the malleoli, due to rupture of the tibiotalar ligaments, must not of course be forgotten but the major point in the treatment of this common lesion is to put the foot, at the beginning in the position which it later usually finds it impossible to assume, a position which approximates the minor fragment to the major fragment, the position of full normal supination. With this forgotten and all the rest remembered, a disappointing result may be expected with this remembered and all the rest forgotten a practical foot is still attainable.

Quite recently I have been able to apply this principle to the treatment of a fracture just behind the head of the proximal phalanx of the thumb of a little girl. The fracture was an extension fracture and the parts had

partly united in this malposition. Flexion of the distal phalanx was impossible and an incision was needed to separate the forming union. The parts were dressed with the phalanx in flexion and the result has been most satisfactory.

Beginning the study of the lesions I have mentioned at the point where our surgical ancestors left us, and departing from older classical methods in the light, more especially of radiographic demonstration, independent workers have devised these new plans—Mitteldorff, Osgood and Penhallow and Monk at the upper humeral and Jones at the lower humeral fractures and Whitman in fractures of the femoral neck—and all have perhaps unconsciously conformed to the proposition that the limb in the new method is put at the normal limit of motion in the direction in which motion is most difficult to attain after older classical methods. There is but one unavoidable qualification: the position must be one which secures and maintains normal alignment of the fragments and for the fractures I have mentioned this qualification is properly met.

One more fracture may possibly be added though purely on a *a priori* ground and that is fracture just above the femoral condyles. It is conceivable that such a fracture, once it has been properly reduced, could be very easily kept in place by flexion of the knee. Reduction without an incision, however, is difficult because traction on the leg is lost in the long muscles which pass from the tibia to the pelvis and affects the minor fragment but little. Reduction through an incision is relatively easy and then the normal treatment at the present time is to use internal fixation methods such as screws and plates or staples, so that the positional method has had no opportunity of trial. If internal fixation methods are not available and if proper reposition of fragments can be secured the positional method is, I think, one that can be legitimately tried.

In addition to the list of fractures here given there must be considered the whole class of epiphyseal separations. These are necessarily fractures near joints and they are also fractures in which the minor fragment has

less attachment to the major fragment than it has to the other bone component of the joint. They are fractures in which normal alignment can commonly be maintained once a proper reposition has been secured with the parts in conventional position but they are, I know from experience, fractures which respond readily to the plan outlined in this paper and with the parts put at first in the position which usually is difficult to attain, reposition of fragments will be easily kept, healing will occur normally and full function will be most readily and quickly regained.

Instead of citing specific epiphyses and particular joints I put this general statement concerning the whole class into this separate paragraph for the purpose of emphasis.

The placing of internal fixation apparatus, steel plates or screws or staples to hold the fragments in the case of a fracture near a joint, opens two questions, the first relates to the firmness of the hold on the fragments, the other relates to the effect on the mobility of the joint. There is still not a little vagueness in our ideas of the mechanical value especially in point of time, of screws penetrating the bone. All who have had to take out plates—and that includes practically everyone who has put them in—testify variously as to the firmness of location they found. A couple of years ago Willard Bartlett in a most interesting paper before the Section on Surgery of the American Medical Association at the Los Angeles meeting, testified to the surprising amount of force that was required to pull from the relatively light bones of the dog freshly placed or recently placed screws. His experiments related to screws placed in the diaphyseal cortex, and some of them were intentionally infected while some were not so. The point to be made here is that they were all idle screws—screws that held no plate on which no weight came, that were doing no work. It seemed to me that there was such a difference between this idle screw and the screw on which a weight hung that the following experiment was done. In the femur of a medium-sized dog two screws were firmly set about 5 cm apart. A light elastic band was then placed around them so that a little pull was

constantly made by the rubber. The wound was closed. After a time when the wound was opened both screws had been drawn from their holes by the elastic tissue of the living bone had been absorbed under the pressure generated by the pull of the elastic and the screw had lost their hold. Now screws placed in the cancellous tissue of the bone ends have primarily a less firm hold than have those in the cortex of the mid shaft and secondarily absorption around them must take place more rapidly for the total amount of bone in contact with them must be less than it would be in the shaft therefore the expectation of work from them must be lessened both in amount and in time. Screws and staples have therefore but the value of temporary coaptation methods and the real support and control of the parts must be arranged for by a proper splint, an external retentive apparatus.

The proximity of a plate or a screw to a joint cuts no figure provided there is no infection and the screws are not in the way of

the moving parts of the joint, the tendons, ligaments and bones. Lane pictures a plate running down to the tip of the internal malleolus with a screw in its end hole. Screws have been put into the olecranon. I have put a silver band 1.5 cm. wide around the femur just above the condyles, in which position it lay beneath tendons and blood-vessels and nerves on the posterior surface and the extension of the synovial membrane upwards on the anterior surface. For seven years this has stayed in place on a limb actively engaged. Provided that moving parts are not interfered with and no infection is present there need be expected no extension of reparative inflammatory processes to the joint producing an ankylosis, though it is quite to be expected that such a joint shall be somewhat stiff when it is first taken out of its splints, due to splint restraint and disuse. This will naturally pass away and joint function will be regained provided the moving parts of the joint are not encroached on by the foreign bodies.

## PART II — FRACTURES INTO JOINTS

Fractures which enter joints affect not only the anatomy of the bone but also the physiology of the joint, and not only may they upset the joint surfaces so as to mechanically interfere with normal motion but they may excite adhesive inflammatory processes in that unstable connective-tissue structure the synovial membrane. Leaving out of consideration, for the moment the more serious fracture lesions of joint we shall see how many of the ordinary ones fall easily under the rule which has been formulated. We have only to think of fracture of the humeral external condyle in which the minor fragment — which includes not only the capitulum but commonly part of the trochlea — is pulled downward and forward by the supinator longus and healing in this position, offers a distinct obstacle to the radial head in the motion of flexion. But this same fragment is pushed upward and backward into its proper place by the radial head if the elbow is dressed in full flexion, and healing then offers no obstacle to flexion. In fractures of

the carpal scaphoid a little bone over which many of us may stumble Mr. Robert Jones says: "The main disability consists in a loss of the power of extension. We, therefore at once secure our right of way by hyperextending and fixing the wrist in hyperextension." "If such a case be seen early and the wrist be hyperextended and kept in that position for about fourteen days an excellent functional result can be assured."

Some of the fractures I have already instanced, for example fracture of the femoral neck high up and Pott's fracture, enter joints but neither of them call for a fixation plate or screw on the articular surface or near it both being amenable to extra-articular intra-osseous apparatus if any is needed.

To the cases where fracture lines so upset joint surfaces that mechanical obstacles are set in the way of motion and where neither positional methods nor splints are efficient in holding fragments in place one's mind naturally turns to the use of internal fixation methods. Are screws and plates tolerated

inside a joint? Would it be right to put them in a joint and, if so should they be kept off the articular surfaces or could they be placed on the articular surfaces even on the bearing areas of such surfaces?

In 1890 Charles Phelps<sup>1</sup> of New York reported a series of cases of fractures of the patella treated by longitudinal ligation with silver wire. On the articular surface the wire was laid in a groove cut in the cartilage for its reception. Phelps stated without clinical or post mortem proof that the wire would be covered in and cause no subsequent trouble.

A careful search of surgical literature fails to reveal other instances of intra articular fixation appliances.

We, therefore, decided to submit the problem to the test of experiment. In the first place we recognized that joint cavities have, until the last decade or so, been shunned by surgeons on account of their relatively lower resistance to the minimal infection. This probably is due to the fact that the synovial membrane has no endothelial surface as has the peritoneum but merely a layer of laminated connective-tissue, so that its power of dealing with infection is far inferior to that of the peritoneum. Modern surgical technique, which has taught us manipulation of parts without hand or even glove contact, has overcome the objections which lay against an operation where direct handling was necessary and experience has shown that joint cavities, like all other body cavities could be and were entered safely with proper precautions. The recent work of Handley on the reposition of epiphyses and Hallopeau's monograph on the treatment of fuxta articular tuberculosis illustrate the tendency to reconsider the generally admitted risks involved in the opening of joints.

We selected dogs and cats as the most suitable animals for this work and the knee joints as the best joints — using one knee at one sance and if all went well with it, the

second at a subsequent sance. The hair was removed by a depilatory and the field then painted with 5 per cent tincture of iodine. The skin was incised longitudinally in the medianline directly over the quadriceps tendon which was retracted laterally carrying with it the patella. The joint was then entered by an incision external to and parallel with the tendon. These incisions were practically bloodless. The U-shaped incision had much to commend it, but it had the disadvantage of cutting the patellar ligament. The femur was the preferable bone but in some instances the tibia was chosen. In the joints we used screws of steel, of plated steel and of brass, and in some instances we put in small plates of annealed clock spring with brass or plated screws. In one dog an autoplatic bone peg was used — cut from the tibia. An effort was always made to sink the screws so that the head was flush with the surface of the cartilage, and if a plate was used the cartilage was cut away so as to countersink both plate and screw but this was often difficult because of the small size of the joints and the thinness of the cartilage. Closure of the wounds was by catgut or silk or linen for the capsule of the joint and linen or silk for the skin using the Willard Bartlett stitch for the latter. The incision was painted with iodine neither dressing nor splint was used. In all of the eighteen experiments Lane's technique was followed, the tissues being disturbed as little as was possible.

In the earlier experiments the screws were put outside the limits of the articular cartilage through the cortex on the side of the bone, but within the capsule. In some instances a condyle was cut loose except for the periosteal attachments and then fastened again into place by a lateral screw. In most of the experiments, however the screws, staples, etc. were put through the bearing area of the articular cartilage.

When screws were placed on the cartilage, both the early and the late effects varied with the degree of success of the counter sinking of the screws.

*Early effects with well countersunk screws.* During the first three or four days there was very slight swelling of the joints, which

<sup>1</sup> T. M. J. 1890, 4, 397.  
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<sup>2</sup> Hallopeau. La destruction thermique dans le traitement des ostérites des os. Paris, 1913.

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<sup>1</sup> T. M. J. Feb. 11, 1917.  
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<sup>2</sup> Hallopeau. La dévitalisation temporaire dans le traitement des tumeurs du pied. J. anat. 1911.

were tender to handling. The animals usually would walk some on the limb but with a limp. In some cases (dog and cat) as early as the fifth day the animal used the limb freely and almost invariably with no limp (Fig 1). There was rarely any evidence of effusion, except in the earlier cases in which the technique was faulty and there had been too much traumatism of the parts. Even in these cases the aspirated fluid was sterile aerobically and anaerobically excepting in one case of staphylococcus albus infection.

**Early effects with insufficiently countersunk screws.** In this group function remained normal in the cases of slightly projecting screws or plates. With screws or plates projecting a one half mm. or more into the joint cavity (Fig 2) usually the animal refrained from using the limb; there was slight swelling and tenderness was more marked than in the first group. In some cases aspiration showed a sterile blood-stained mucilaginous fluid. After ten to fourteen days however the animal began to walk limpingly on the limb and at that time there was rarely any evidence of effusion; arthritis was only noted once.

**Late effects.** In the first group the joint was used as a normal joint. The animal's gait became absolutely normal as early as the fourteenth day and remained so (Figs 3 and 4).

In the second group function was normal in many instances. In other cases there was a slight limp for four to six weeks and sometimes this wholly disappeared. In the majority of cases belonging to the second group however the limp persisted but was less. In three limping cats killed during the third month there was some evidence of arthritis, probably caused by the excessive size of the intra-articular screws (Fig 5). Numerous necropsies from the third week to the sixth month proved that the tenderness of the joint and the disinclination on the animal's part to use the limb coincided with the time during which the screw was cutting away the opposite cartilage, and that when this had been accomplished, and the cartilages of both bones came properly in contact and the screw head bore no weight, the animal

began to use the limb the gait becoming normal very soon afterward (Figs 6a and 6c).

#### HISTOLOGICAL DATA

**Joint Cavity.** The introduction of screws, plates, staples, etc., invariably gives rise to a well marked local reaction which does not differ in its essential features from the usual connective-tissue reaction to foreign bodies. Varying in extent according to the relation of the screws, etc., to the pressure bearing cartilaginous surfaces, this reaction consists of a newly formed fibrous tissue which rapidly covers the screw or plate and excludes it from the joint cavity (Figs 7, 8, and 9). Dense on its free surface the newly formed lamellated connective-tissue is of the loose alveolar type in the deeper areas. The cells are elongated and arranged parallel to the joint surface. In some specimens the superficial cells resemble endothelial cells. Serial sections show clearly the growth of the connective tissue arising from the marrow. There is no evidence of new-bone formation or of regeneration of cartilage. There are no other changes in the joint cavity.

When the screw or plate is insufficiently countersunk the reaction does not differ except as to extent, from that above described, only the part which is free from pressure will be covered by the newly formed fibrous tissue. In some experiments the tissue filled only the groove in the screw-head; the uncovered part of the screw was polished by friction against the opposite bone and usually it had cut a path in the opposite cartilage through which it moved easily.

**Bones.** In the bones the local reactions were the same as with extra-articular screws and nails. Late observations (four months) show the screws and staples firmly embedded. In some instances their removal necessitated the use of the chisel. With an autoplatic bone peg (Uthia) there was less reaction, but the peg was rapidly absorbed so that an eight weeks' specimen showed only traces of it, its place being partly taken by new bone. In the cases where more than one metal or a plated screw was used, the staining of the bone around the foreign body would seem to suggest an electrical reaction.



FIG. 3. Dog four months after operation. One screw has been well counter sunk. Cat was normal.

#### CONCLUSIONS FROM EXPERIMENT

1. Dog and cat offer exceptional facilities for the study of juxta and intra articular fractures.



FIG. 4. Dog same as FIG. 3. Four months after operation. Both one screw well counter sunk and one not. The ear quite normal as shown in fig.

2. The trans-articular method is the only practical method which gives perfect access to certain joint fractures and permits accurate reposition of the fragments.

3. The innocuousness of the trans-articular route for the reduction of these fractures may be considered demonstrated.

4. There would seem to be a decided mechanical advantage in using intra articular screw or screw and plates to insure the

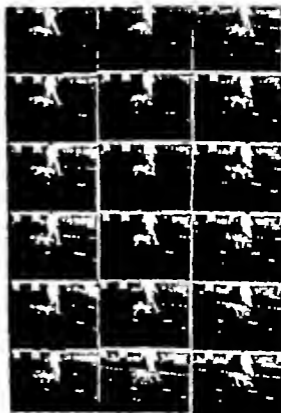


FIG. 5. Part of moving picture film which showed the dog jumping.

accurate maintenance of the replaced fragment.

5. Screw and plates so used seem to be *per se* innocuous. Aside from the trauma incidental to their trans-articular insertion, the reaction following the introduction of screw and plates does not differ from that caused by a foreign body in other connective tissues of the body. When properly counter



Fig. 5. Cat three months after operation, showing screws disproportionately large and permanent lump.

sunk they are rapidly excluded from the joint cavity by a layer of newly formed fibrous tissue which grow up from the marrow spaces. Under aseptic conditions the ultimate fate of intra articular metallic fixation appliances



Fig. 7. Laminated fibrous tissue covering intra-articular plate.

is the same as that of extra articular appliances; they remain firmly embedded.

6. *Per se* the screws cause very little more reaction than the autoplasmic bone peg.

7. The use of two different metals in the screw and plates does not change the result in the articulation except so far as the possible electrical reaction is concerned in the staining of the tissues.

8. Even with slightly projecting intra articular screw or plates, the function of the joint rapidly becomes normal. The direct wearing away of cartilage by an insufficiently countersunk screw head does not lead to intra or extra-articular deformities, except under faulty technical conditions.

Experiments of this kind are of course, of no value unless their results can be utilized in the treatment of fractures entering joints in man. So far neither of us has had occasion to use an intra articular screw and what has to be said on their applicability in man must be held to be theoretic — but neither of us would hesitate a instant to put a screw of proper size on any part of the surface of any joint if the conditions seemed to require it.

In the experiments the joints were normal just as in man they would presumably be in a traumatized joint and the reaction to the fracturing trauma would have to be considered — but we believe that even in the presence of trauma the trans articular replacement and maintenance of the replaced



Fig. 6



Fig. 6b

Fig. 6. Dog four c/m after operation showing poorly countersunk screw and groove (A) cut in deep post cartilage by the screw head. Slight lump.

Fig. 6b. Dog 4 1/2 months after operation showing poorly countersunk screw and groove (A) cut in the opposite cartilage by the screw head. No lump.



Fig. 8 Showing repair of groove in the patella



Fig. 9 New formed fibrous tissue sprouting from the marrow spaces and extending over the screws

fragments or epiphyses by position or by screws will give a less totality of trauma than permitting the persistence of displacement with its consequent disability. We believe that the method of extending to intra articular fractures the internal fixation apparatus used commonly in extra-articular fractures, will result in the saving of more useful joints. We recognise the full value of the need of absolute asepsis, and the grave dangers resulting from unnecessary handling of tissues in this work and we agree in the

opinion that screws, etc. should not be used in open fractures into joints as an immediate method but they may be used at a later period after the external wound has healed and the joint is free from infection.

The trans-articular route is suggested as the method of choice in fractures traversing joint surfaces (or displaced epiphyses) when anatomical apposition of the fragments can not be maintained except by the use of some internal fixation apparatus.

## TUMORS OF THE NECK

B F MCKENTY M D F R C S ENG MONTREAL, CANADA

### CONTENTS *Introduced on*

*Embryology of the neck*

General morphology of pharyngeal pouches

The ductless glands of the neck

Branchiogenic Cysts	(a) General characteristics, clinical and pathological
	(b) Reports of cases
Branchiogenic carcinoma	ditto
Thyroglossal cysts	ditto
Carotid body tumors	ditto

with in the Royal Victoria Hospital during the last ten years show the following

A Branchiogenic cysts	15
B Branchiogenic carcinoma	5
C Thyroglossal cysts	9
D Carotid body tumor	1

In this paper we present a view of the present state of knowledge upon the embryology of the region in relation to the surgical pathology of the tumors and enter into a discussion of the difficulties of microscopic diagnosis and other points that appear worthy of comment in the series of cases tabulated.

**T**UMORS of interest from an embryological or developmental point of view occurring in the neck, are of great importance on account of their difficulty of diagnosis and their comparative frequency. The records of such cases dealt



formation of the precervical sinus (Fig 3) which is the probable source of many of the lateral dermoids of epithelial character found in the neck.

The precervical sinus is formed because the first (mandibular) arch and the second (hyoid) arch grow more rapidly than the rest of the arches. Thus more rapid growth takes place in all directions and has the result that the slowly growing caudal arches appear to sink into a depression—the precervical sinus. This at first is widely open laterally but soon the posterior edge of the hyoid arch grows backward over the mouth of the sinus to form an indistinct operculum. Under the edge of this operculum the sinus retains for some time its connection with the exterior, the opening being known as the cervical duct. After a time the operculated edge

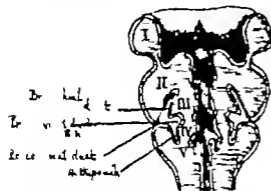


Fig 3. Showing the formation of the precervical sinus, the branchial duct, and the precervical sinus (Cunningham).

of the hyoid duct fuses with the tissues of the neck thus blocking the duct and enclosing a blastoma sac, the cystic precervical sinus. This little sac lies lateral to the third pouch but is connected by a duct with the external branchial pouch (Fig 4) which has become a short tube. It can be seen in Fig 3 (branchial duct). Neither the cystic nor the branchial ducts persist for long. Then the tube disappears, the epiblastic folds forming the diaphragm and anastomosis. It is known that in failure of these retrogressive processes must be the effect of less long cells of an epithelial character buried in the neck provoking all the necessary factors for the subsequent production of tumors.

It is not necessary for the purposes of this paper to enter fully into the history of the more widely placed arches but there are certain points taking place in their neighborhood of all interest. First, a fairly brief reference. The tubercle of the first of the three pouches which separates them from the second one or more ducts (glands)—the thymus (from the epithelium of third pouches) has the same rudiment from corresponding epithelium of (fourth pouches) the parathyroids (from third and

fourth pouches) and the thymic branchial bodies (so called lateral thyroid from the fifth pouch) (Fig 5). The fate of the ultimo branchial bodies is unknown but they are probably embedded in the thyroid gland. The developing ultimo-branchial bodies used to be regarded as lateral thyroid rudiments, but there is now little doubt that this view was incorrect (Verduin).

The development of the middle line of the neck needs for description a more detail in order that certain abnormalities in connection with the thyroglossal duct may be more clearly explained. An examination of the floor of the mouth of a 5 mm embryo (Fig 4) shows a rhomboidal depression in the median line between the central ends of the first and second branchial arches, a distance from these there rises a dorsal projection of rounded form, known as



Fig 4. Floor of the mouth and pharynx of an embryo of 5 mm. (After Ellis.) I, first branchial arch; II, second branchial arch; Br. tubercle; Br. vein; Br. cisterna; A. thyroideus. The by road evagination is indicated by a dotted line.

the tubercle. Behind this is a deep epithelial (hypoblastic) pit which is the thyroid evagination (the road anlage). This grows out expanding in all directions especially laterally; it forms stalked buds, however, which become obliterated later. Prior to its conversion to a solid epithelial cord the tubercle of the cystic constates the thyroglossal duct. The site of its opening into the mouth is marked in the adult by the foramen caecum, which is in reality a short but varying length of the stalk of thyroid tissue which has failed to solidify and disappear.

After the solidification of the duct the cystic becomes bilobed and displaced caudally eventually developing into a broad structure composed of irregular cords of cells. The ultimo branchial bodies pull themselves out of this mass and are as indicated but probably enclosed by it. The thyroglossal gland belongs therefore primarily to the medial region but on the first ventral pharyngeal grooves and becomes displaced caudally until it reaches the position which it occupies in the adult form. This explains why the thyroglossal



Case Defect in fusion of tubercles (right side). Photograph by Dr. Goldert



Case Same case showing defect in formation of oral fissure



Absence of external auditory meatus (left side)

duct when it persists, usually runs posterior to or occasionally through the hyoid bone and why it is so difficult to remove it surgically (Fig. 6).

The carotid body, which was looked upon for some time as developing from the epithelial structure of the third pouch, is now definitely placed in the category of the chromophil system. Further its formation with regard to its development will be found in the section on Carotid Body Tumors.

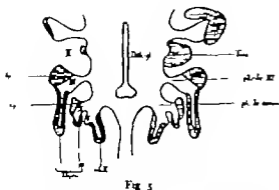
To sum up, the persistence of portions of the branchial system which normally disappear gives rise to cysts, fistulae and tumors. The region corresponding to the ductus branchiales and the ductus precervicalis is found at the anterior border of the sternomastoid (figure). If the development of vessels be normal a fistula of the second cleft must lie between the external and internal carotids; third cleft, common carotid and jugular; fourth cleft, bend around the subclavian on right side, arch of aorta on left side.

The last named is very unlikely to arise, and indeed it is only fistulae of the second cleft that have hitherto been recognized with perfect certainty (Fig. 7).

#### BRANCHIOGENIC CYSTS

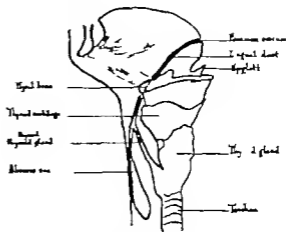
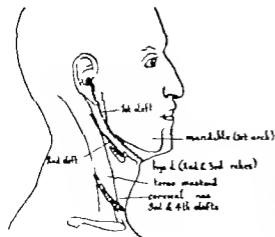
These cysts arising from the branchial system of clefts (see embryology) are of very

common occurrence and give rise to considerable difficulty of diagnosis. Indeed in many instances it is only after microscopic examination of their walls that their true nature is discovered. In the hospital 15 cases have been treated, the youngest occurring in a baby of 9 months, the oldest in a man of 70. The majority occurred between the ages of 20 and 40. Sex seems to have but little bearing as in our cases 8 were male and 7 female. Clinically they usually have a slow painless growth over which the skin moves freely. The rapidity of growth arises and occasionally variations in size have been noted, due probably to a sudden increase or decrease in contents. At other times they increase to a certain size then remain stationary. A not uncommon complication which after the general course is secondary infection of the content of the cyst as occurred in one of our cases following tonsillitis. Occasionally they rupture externally leading a persistent sinus. The situation in which these tumors are most frequently met with is just below the angle of the jaw at the anterior border of sternomastoid. The duration of time before patients sought relief varied from a few months to thirteen years. Ever since here in the



hospital and also a study of the literature reveals the fact that they have been most frequently diagnosed as tuberculous glands. Especially is this likely to occur when suppurative has taken place. The finding of a portion of cyst wall or the contents of the cavity usually is sufficient to settle any doubt as to what its nature is. The prognosis is good, as these tumors usually readily shell out and do not recur. The one great danger is the possibility of malignant change which unfortunately is not so very infrequent (see bronchiogenic carcinoma, Case 1).

**Pathology** They usually possess a fairly thick fibrous tissue capsule lined inside by a variety of forms of epithelium. In the majority of cases the lining consists of a stratified layer of horny pavement epithelium frequently showing papillary projections into the lumen.



and here and there may be seen the so called sweat or sebaceous glands. Again, the lining may be more of the columnar type in which case the contents are of gray-starchy or mucous character. In the first case the contents usually consist of a fatty atheromatous material containing cholesterol crystals and absence of bacteria in non-infected cases. The wall often looks soft and edematous with numerous blood vessels and a great amount of lymphoid tissue with many germ centers.

Below are the descriptions of the fourteen cases previously mentioned:



Fig. 8. Cystic Branchiogenic cysts.

CASE 1. R. Cully, male, aged 3. Seat of disease: Right angle of lower jaw. Duration of symptoms before admission: One year. Chief features of illness: Freely movable, smooth, painless and tense. Treatment: Shelled out. Cyst lined by prominent epithelium and filled with sebaceous material (Fig. 8, Case 1).

CASE 2. C. Leflore, female, aged 9 months. Seat of disease: Below front right ear. Duration of symptoms before admission: Since birth. Chief features of illness: Discharging at times with less material. Treatment: Excised. Stricture lined by squamous epithelium.

CASE 3. F. Worrell, female, aged 4. Seat of disease: Left angle. Duration of symptoms before admission: Three months. Chief features of illness: Fixed in size. Treatment: Shelled out.

CASE 4. G. Mitchell, male, aged 5. Seat of disease: Left angle. Duration of symptoms before admission: 7 years. Chief features of illness: Seemed adherent to skin per structure. Skin freely movable on it. Treatment: Shelled out. Chiechik material. Culture sterile.

CASE 5. J. Wade, male, aged 9. Seat of disease: Left angle. Duration of symptoms before admission: 2 years. Chief features of illness: Painless enlargement. Treatment: Shelled out. Chiechik material. Cyst wall lined by squamous epithelium.

CASE 6. Mrs. L. Chalmers, female, aged 33. Seat of disease: Right angle. Duration of symptoms before admission: Three years. Chief features of illness: Painless enlargement. Treatment: Shelled out. Chiechik material with holocystic crystals & bacteria.

CASE 7. Mrs. J. Leggett, female, aged 7 years. Duration of symptoms before admission: Four months. Chief features of illness: Painless enlargement. Treatment: Shelled out. Contained cheesy, colorless material. Lined by stratified epithelium.

CASE 8. L. Longat, male, aged 7. Duration of symptoms before admission: Two years. Chief features of illness: Small mass on right side above suprasternal notch grew rapidly at last. Treatment: Cyst dissected out. Lined by stratified epithelium. In several small papillary projections hairs growing out one or two places.

CASE 9. M. M. Perquitt, female, aged 46. Seat of disease: Left side of jaw. Duration of symptoms: Two years. Chief features of illness: Grew slowly, freely movable, painless. Treatment: Shelled out. Contained cheesy material.

CASE 10. C. Kent, male, aged 4. Seat of disease: Left side of jaw. Duration of symptoms before admission: Four years. Chief features of illness: Grew slowly at first, then more rapidly. Color of orange. Freely movable. Treatment: Shelled out. Contained grayish turbid fluid. Walls thick, with lymphoid tissue.

CASE 11. P. Turner, male, aged 3. Seat of disease: Right angle of jaw. Duration of symptoms: Three years. Chief features of illness:

Grew slowly, freely movable. Treatment: Dissected out.

CASE 12. C. Andrews, male, aged 55. Seat of disease: Right side of neck above thyroid cartilage. Duration of symptoms before admission: Thirteen years. Chief features of illness: Grew gradually, freely movable. Treatment: Incision and shelled out. Brown, stiff fluid.

CASE 13. Emma Deane, female, aged 20. Seat of disease: Left jaw. Duration of symptoms before admission: Six years. Chief features of illness: Grew gradually. Varied in size. Bulged into mouth. Fills up submaxillary space. Treatment: Cyst shelled out. Contained grayish material in ten 1. Wall thick. Blood vessels numerous. Lined by epithelium.

CASE 14. M. F. female, aged 30. Seat of disease: Below angle of right jaw. Duration of symptoms before admission: Six years. Chief features of illness: Grew gradually. Size of small nut, then broke, and since that time a fleshy discharging small amount of glairy material has persisted. A probe inserted, long track of fluctuation passed, and moved forward but apparently did not open directly to pharynx. Operation refused.

#### BRANCHIOGENIC CARCINOMA

This term is applied to tumors which arise from the epithelium of branchial clefts or secondarily to carcinomatous change in branchiogenic cyst. Our knowledge of these tumors was first furnished in 1883 by Richard von Volkmann, who had observed three cases of neck carcinoma in which there was no original growth in the skin or in the mucous membrane of the nose, mouth, pharynx, larynx, esophagus, or ear and which did not originate in lymph-glands. The record of the Royal Victoria Hospital shows five undoubted and two doubtful cases, six occurring in males and one in a female. Age also seems to be of importance; the youngest person affected being 44 and the oldest 73; the remainder were between the ages of 53 and 65 (see cases). The right side was affected in three of the undoubted cases, the left in two. The one remarkable feature of the clinical history is the tremendous rapidity of growth in all our cases with the exception of Case 1, which is an example of secondary carcinomatous degeneration of a branchiogenic cyst. The tumor mass is usually situated behind and below the angle

of the jaw it is hard and fixed and the skin over it is movable. Pain which in very early cases may be absent is usually severe caused by the involvement of nerves in the region of the growth. It is not probable that an accurate diagnosis can be arrived at in many of these tumors before they are removed and histologically examined. The diagnosis must rest on this that an epithelioma of the neck which does not involve the skin or mucous membrane and of which no original focus can be found in these structures is to be looked upon as a branchiogenic carcinoma and it is well in our clinical examination of deep cervical tumor to bear in mind the possibility of the growth being of this type. The necessity of a thorough examination of the mouth *pharynx* and *larynx* cannot be emphasized too strongly as a growth not as large as a split pea will give rise to very extensive metastases. More than one experienced surgeon has learned for the first time at post mortem the presence of a primary growth in the pyriform fossa which had escaped his notice in the ordinary routine examination.

**Prognosis** Is distinctly bad. In the Royal Victoria Hospital the mortality was 100 per cent. This is partly due to the situation where so many important structures are early involved and also to the extreme malignancy of the tumor. Case 3 died of cerebral metastases.

**Pathology** The type of tissue presented by this group of carcinomata is usually quite characteristic in that the cell masses are very large and stroma tissue infinitesimal. The individual cells are themselves characteristic because they tend to be regularly polygonal, have very pale cell bodies and rather small nuclei with punctate chromatin. The result is the formation in a section of a pavement epithelium like structure. The rapidity of growth is estimated by the abundance of mitoses of aberrant type. The case in point constitutes a borderline between this form and the indeterminate tumors designated as endothelioma or perithelioma. The perithelioma as is well known is made up of small rounded masses of cells that possess mainly a spindle or columnar form and are arranged in

whorls of very striking appearance. The intertrichous connective tissue is very abundant and tend to be arranged in laminae around the parenchymal cells. Even here the constituent cells possess neoplastic traits, being of short spindle form with relatively large pale round nucleus. Between these two extremes we have a form in which acinous masses of some size are separated by considerable amounts of laminated fibrous tissue. The acinous masses are found to comprise two form of cells, the first one having a decidedly epithelial form being large polygonal with relatively small pale-staining nucleus and intermingled with peculiar round large bodies known as cancer bodies. In some cases these cell groups closely resemble the epithelial pearls of a cutaneous carcinoma. The second type is much smaller arranged in stratified form and tends to possess a columnar shape although the stratifications give rise to an egg-shaped or spindle shaped form in many instances. The nucleus stains very deeply and is relatively large. The cytoplasm is more acidophile than is the case with the first type. The central part of the acinus is especially characteristic because it consists entirely of necrotic cells, which form a granular red-staining mass lying free in a sort of cystic cavity whose walls are perfectly regular owing to the free edge of the stratified epithelium having an even contour. A few scattered nuclei are visible in this necrotic mass. Sometimes blood is present in large amounts. It will be seen that here we have a form of acinous carcinoma of impure type some of the cells being of squamous aspect. On the other hand the radial arrangement of the stratified cells is exactly that of endotheliomatous masses. The growing edge of such a tumor shows tongue shaped sproutings which probably represent inasion of lymphatic clefts for some distance beyond the main tumor although there is a possibility of the stroma cells themselves developing parenchymal characteristics.

Below is the description of the five cases previously mentioned.

**CASE** Ross Males, male aged 3. Sent of disease Right and below angle of jaw. Duration of symptoms before diagnosis One year. Chief

features of illness. One year ago small mass appeared below right jaw, anterior border of sternomastoid. Grew gradually was at first movable tapped on one or more occasions and only blood stained serum removed. Afterwards skin and underlying tissues became adherent.

**Pathology.** Cyst contained cheesy material. Sections of tumor removed show fleshy adult fibrous tumor covered on surface by stratified epithelium which also a papillary like projections into central space. There is also extensive infiltration of muscular and fibrous tissue with epithelial cells. An incision of mass disclosed a multilocular cyst at base of which tumor was found which was adherent to deep vessels of neck. Attempts at removal.

**CASE 3.** I. Stephens, male, aged 53. Seat of disease. Right side below angle of jaw. Duration of symptoms before admission. Seven weeks. Chief features of illness. Seven weeks ago noticed small mass which grew rapidly and early pain developed in region of boulder up side of neck. Tumor more large and firm, adherent to deep structures. Skin moves over it. Structure. Portions of tumor removed show typical alveolar structure consists of cells of moderate size and fair amount of chromatin stroma moderate. In most places small cell infiltration. Tumor mass infiltrating muscles and vessels. Attempts at removal.

**CASE 4.** J. H. Wells, female, aged 57. Seat of disease. Left side of neck. Duration of symptoms before admission. Five years. Chief features of illness. Eight years ago tumor removed from neck. 1893, another small mass was removed from posterolateral aspect of orifice. Microscopic examination of this tumor showed epithelial overgrowth continuing all next. Origin uncertain. Occurrence of trouble for eleven years. Then small tumor developed on left side of neck lying just behind angle of jaw side of the neck. Skin free over it. Evidence of fluctuation. Incision into mass. Tumor consists of papillary or endothelial cells infiltrating fibrous tissue stroma, consists of young and old fibrous tissue. Some hyaline degeneration with most to round cell infiltration. Attempts at gland removal. Cells large cubical joined edges. Edge of cell cytoplasm. Neck round and well defined.

**CASE 5.** Martin Feron, male, aged 6. Seat of disease. Left side of neck. Duration of symptoms before admission. Ten weeks. Chief features of illness. Small mass appeared four weeks ago which grew in one night nearly to size of admission. At first painless, but later pain has been severe radiating up head and to shoulder. Tumor mass firm and size of tangerine. Skin free over it but tumor attached to deep structure. Treatment. No operation. Examination of throat by Dr. Birckett revealed nothing. Tumor was diagnosed branchial carcinoma, or probably secondary to previous mouth ulcer.

**CASE 6.** E. Louch, male, aged 4. Seat of disease. Right side. Duration. Three months. Chief features of illness. Three months previous, below and behind angle of jaw on right side of neck, painless, firm mass size of hazel nut noted. Shortly afterward small growth appeared under lobe of right ear. Masses remained stationary for short time then began to grow suddenly and stabbing pain noticed which became worse as growth increased. Shoulder muscles became weak, and pain radiated down shoulder. Slight loss of eight history of syphilis. Mass now size of large hen's egg hard fixed at distance. Treatment. Tumor easily belled out below but boy infiltrated jugular vein. This is also removed. Died January 1, 1909.

**Microscopic appearance.** The specimen consists of tumor of the neck which has infiltrated the muscles in the vicinity. The growth is firm, has grayish white appearance with yellow spots here and there. There are numerous lymphatic glands amongst it which are invaded.

**Microscopic appearance.** Sections show large bands of connective tissue which are erythrocytic. Lying in these bands are masses of cells. These cells vary in appearance for the most part are low columnar and often spindle shaped again they are often more endothelial in type and in several areas look like squamous cells, but so prickles have been noted. The general arrangement of the mass of cells is that of an endothelioma arranged in relation to blood vessels. The central part of the mass of cells is often degenerated. Other sections of same tumor taken from different parts resemble very much spheroidal-celled carcinoma. Blood vessel are numerous and possess fairly well developed walls.

#### THYROID GLANDS

C) is arising in obliterated thyroglossal duct, the old connecting link between foramen cecum of tongue and isthmus of thyroid (see embryology).

**Frequency.** We have collected from our records only one case, seven occurring in male and two in female the youngest five years and the oldest 56 years.

The are situated in the middle line usually in relation to the hyoid bone or to the upper border of the thyroid. They grow slowly but show a rapidity of growth.

The tumor appears as a painless cystic swelling which may break through the skin forming a median fistula discharging a mucous like material.

**Prognosis.** Is fair but recurrence is not uncommon owing to the failure of the surgeon

to follow it through or behind the hyoid bone.

**Diagnosis** This is not very difficult, but such cysts must be distinguished from (1) the ordinary sequestration dermoid found in the middle line in any part of the body but especially frequent in occurrence in this particular locality (2) ordinary sebaceous cysts, but the facts that these latter are entirely in the skin and do not occur before puberty are usually sufficient to separate them from the true thyroglossal cyst.

**Pathology** The cyst wall consists of fibrous tissue, in the region of which one often notes atrophied thyroid tissue (see case diagram). The lining is usually of columnar type but frequently flattened from pressure or in cases where suppuration has occurred the epithelial lining may be wanting. Contents usually mucous or starchy gray material.

Below is a description of ten cases previously mentioned.



FIG. 9. Case 5. Thyroglossal cyst from neck. Low power.

**CASE 1** R. Marion, male, aged 56. Seat of disease: Middle line over thyroid cartilage. Duration of symptoms before diagnosis: Six months. Chief features of illness: Gradual painless enlargement. He noted this while eating, which ulcerated it. A small sinus resulted which on flow afforded discharge of bloody material. **Treatment:** Cyst, as found, which extended down the hyoid bone. Excised.

**CASE 2** J. Perry, male, aged 3. Seat of disease: Middle line of neck just below hyoid bone. Duration of symptoms before diagnosis: Present since childhood. Chief features of illness: Remained stationary for some time then gradually increased in size. A discomfort. Skin freely movable over it. It was noted it had a deeper structure.

**CASE 3** H. Patterson, female, aged 26. Seat of disease: Middle line below hyoid bone. Duration of symptoms before diagnosis: Three months. Chief features of illness: Gradual increased size. It was noted it was a hard mass. Discharge of pus. It was noted it had a deeper structure.

**CASE 4** S. L. male, aged 3. Seat of disease: Middle line. Duration of symptoms before diagnosis: One month. Chief features of illness: Gradual increase in size. It was noted it was a hard mass. Discharge of pus. It was noted it had a deeper structure.

**CASE 5** F. Beard, male, aged 3. Seat of disease: Middle line at hyoid bone. Duration of

symptoms before diagnosis: First noticed six months ago. Chief features of illness: When mass was first noted it was size of a marble. Gradual increase in size. Skin over it not adherent. No subject symptoms. **Pathology:** Sac contained a yellowish gelatinous material. **Treatment:** Dissected out.

**CASE 6** DeGarnau, male, aged 5 years. Seat of disease: Middle line over thyroid cartilage. Duration of symptoms before diagnosis: Three years. Chief features of illness: Gradual increase in size. It was noted it grew divided at the halves the rapidly placed a trichy cyst growing laterally. Moved with degeneration. Skin over it felt movable. **Pathology:** Sac contained a yellowish thick creamy material. Cultural or low of minor in several places. Extended through hyoid bone.

**CASE 7** M. Oughtred, male, aged 3 years. Seat of disease: Middle line near hyoid bone. Duration of symptoms before diagnosis: Since 10 and one half years old. Chief features of illness: Mass developed at the neck of tonsillitis as lacerated, discharging a lot of fluid. Cured several times. It was noted it was a hard mass. Discharge of pus. It was noted it had a deeper structure.

**CASE 8** H. Chubb, male, aged 3 years. Seat of disease: Middle line over thyroid cartilage. Duration of symptoms before diagnosis: Six years. Chief features of illness: When first noted a small hard ball increased in size for period of years and then disappeared. Small mass remained

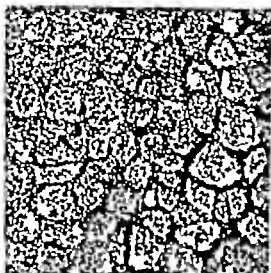


FIG. 1. Glandula carotica. Low power. Carotid body.

which one year later was dissected out and found to go down to hyoid bone. Patient quit well until one year ago when it again began discharging again dissected out did not go down to hyoid bone. *Treatment*. Dissected out. *Pathology*. Sections show fibrous tissue with dilated vessels and rounded cells infiltration.

**CASE 9.** Charles Wood male aged 47. Seat of disease just above isthmus of thyroid. Duration of symptoms before admission one year. Chief features of illness. Small cystic mass adherent to thyroid cartilage with skin freely movable over it. *Pathology*. Sections show fibrous tissue lined by endothelium. An epithelioma.

**CASE 10.** R. Dornault male aged 47. Seat of disease just above isthmus of thyroid. Duration of symptoms before admission one year. Chief features of illness. Small elastic growth increased in size of but then remained stationary. *Pathology*. Walls consisting of ordematous fibrous tissue with thyroid tissue in wall. No evidence of epithelial lining, excepting in one small area where it was of low columnar type (Fig 9 Case 10).

#### CAROTID BODY

The carotid body or glandula carotica (Luschka) ganglion intercaroticum (Anderh) is a very interesting structure situated at the bifurcation of the common carotid, with which it is intimately connected being attached to one of the vessels between which it lies by a connective-tissue stalk (ligament of Mayer) through which it receives its blood supply. It varies in size and shape

gradually increasing in size until the individual reaches maturity after which time it remains stationary. The bodies may be absent on one or both sides. They have a firm elastic feel and the color varies from a reddish gray to a reddish brown. The body is surrounded by a dense fibrous (white and elastic) connective-tissue capsule from which prolongations are sent in dividing the gland into lobes and lobules. These delicate fibrils passing in surround masses of the character of cells, giving the whole structure an alveolar arrangement. The individual cells are large rounded or polyhedral in shape containing a large amount of clear protoplasm with a large round well-staining nucleus. The nerve supply is abundant and is connected with both the cranial and sympathetic systems.

**Embryology.** This body has been repeatedly included in the series of branchiogenic structures derived from the third pouch. It is, however, derived from the chromaffin system, a paraganglion, man and other animals, therefore, probably in mammals in general. Paltauf thought that it had its origin in a circumscribed thickening in the wall of the internal carotid. A Kohn den is the chromaffin elements of the glandula carotica from the nerve plexus which passes from the upper cervical sympathetic ganglion between the carotids. In 43 mm pig embryo he finds in this plexus ganglion cells some of which have large and deeply staining nuclei, and believes that these latter present the specific elements of the carotid gland.

**Physiology.** Stilling demonstrated chromaffin cells in the substance of the gland and various experiments have been carried out along the line of investigation of chromaffin substances found elsewhere. The body of P. Milon prepared a study of the carotid bodies of horse and injected it into the veins of rabbit producing rise in blood pressure like Gomer with glycerine extract produced fall of blood pressure in cats. Various experiments with different investigators have yielded such varying results that at the present time nothing very definite can be said.

**Clinical history.** A review of the literature reveals the fact that tumors are most frequently met with between the ages of thirty and fifty; in other words, after the carotid body has reached its full period of development. The youngest case reported is eighteen, the oldest seventy. The sexes appear to be

equally affected. The tumors usually afford a long history of slow growth and during this period may manifest the characteristics of a benign neoplasm. They are encapsulated, do not invade surrounding tissues and give rise to no symptoms other than deformity. Later on they may take on rapid growth and assume the characteristics of a mildly malignant tumor, recurrences and metastases being reported. In this respect these resemble very much the so called endothelioma.

**Prognosis.** Owing to the tumor's intimate connection with the carotids its removal is attended with considerable mortality, even in benign cases, because as Kaufmann and Ruppener pointed out the ligation of external or internal carotid is so frequently necessary for its complete removal. If it has assumed a more malignant aspect as is evidenced by its increased rapidity of growth and infiltration of surrounding structures, the condition is hopeless and no attempt should be made to remove it.

#### CAROTID BODY TUMOR

There is only one case recorded in Royal Victoria Hospital of this very uncommon form of tumor which occurred in the following patient:

Mrs. J. M., age 60, married. Six years ago for first time noticed small mass size of pea immediately in front and below the angle of the jaw. In one year it grew to size of almond. The growth was slow, progressive and painless. On entrance to hospital the tumor was the size of a guinea, firm, smooth, with an elastic feel. The skin over it was freely movable. No glandular involvement.

**Blood count.** Hemoglobin 85 per cent. Erythrocytes 3,200,000. Leucocytes 6,400. Hemoglobin 75 per cent. No eosinophils. General health good. Sought relief for cosmetic purpose.

**Operation.** Tumor evidently lying in the bifurcation of common carotid. It was free on all sides except at bifurcation, hence could not be separated the external carotid in particular seemed to be so adged for short distance from its origin. External carotid ligatured and tumor removed. Patient developed hemiplegia and died in a few days after operation.

**Microscopic.** Tumor size of hen egg, fairly firm, dark reddish pink in color. On cutting grew to more or less of a lobular appearance.

**Microscopic.** Tumor consists in growing parts of branching capillaries which are often dilated and filled with blood. With the low power it has an alveolar arrangement. This forms an intricate network in the meshes of which are seen the characteristic cells. The capillaries have often fairly thick walls. The cells are packed in these meshes and attached to the capillary wall with often a radiate arrangement giving the picture as seen in perithelioma (indeed, Horst classifies these tumors as such). The cells are large, oval, and polymorphic, containing quantity of clear protoplasm. Nucleus large, vesicular with one or more eccentric nucleoli. Occasionally in the center of cell masses there is necrosis, giving rise to a central lumen. The tumor apparently grows by increase of capillaries forming a network which becomes filled with the characteristic cell. Paltauf and Marchand have already noted the similarity of this arrangement of normal carotid gland to tumor derived from it. New growth in this body causes no increase in internal secretion as it does in thyroid or adrenal (Fig. 1).

#### CONCLUSION

1. The branchial system of arches and pouches is a frequent source of cysts, fistulae and new-growths occurring in the neck.

2. The diagnosis of such conditions particularly branchial carcinoma or the laterally placed dermoid cysts is very difficult.

3. A thorough examination of the mouth and throat is an absolute necessity in all form of neck tumors.

4. Carotid body tumors are infrequent, are usually mistaken for accessory thyroids, and are rarely diagnosed before operation.

5. The study of these various tumors has led us also to consider the tumors found in the parotid region which have been classified in various ways by different authorities. We have in fact a paper in preparation on these tumors. It may not be amiss in this particular paper to say that in our opinion these tumors should be called first or second arch tumors rather than parotid tumors, because in them we find present all tissues which take part in the formation of the arch (cartilage, etc.). From the many and complicated changes going on in this region it is not difficult to assume that a tearing off of embryonic portions of these arch structures could easily account for the mixed tumors found in this situation.

A CASE OF COMMON ILEOCOLIC MESENTERY WITH TORSION<sup>1</sup>

By CAI TAGF HANSEN, M.D. Copenhagen, Denmark

From the Pathological Institute at the Kommun Hospital of Copenhagen (Chief: Lauritz Madsen, M.D.)

THE case referred may probably deserve publication on account of its surgical and anatomical interest.

Fifth Department of the Kommun Hospital (Chief: P. V. Hansen, M.D.) Journal No. 660, 93

Female age 5 admitted October 2, 1913 died October 23, 1913. Tuberculous disposition has never been ascertained. The patient has all ways been lean and meager.

Bow is habitually been natural, but periodically once or twice a year the patient has had similar symptoms as now. It suddenly pains the abdomen, constipation for a few days, and greenish vomiting. Periods appeared for the first time last autumn has all ways been regular. Has never had symptoms from the chest.

Was suddenly taken ill eight days ago with violent pains in the abdomen, principally in the epigastrium, and greenish vomiting. The patient had a movement the day before was taken ill. Scanty hard stools at home a day later none more. Can give no information as to illness. The patient's memory not quite clear. She has not been able to eat at all, nor has she slept during this time. Has long failed considerably. Micturition in order. She is tall slim and very meager. Pulse of the skin is greatly reduced. The tongue is partly dry, not coated, hypoparalysed. The herks slightly dusky. Throat is very narrow. A stethoscopic changes of lungs or heart is detected.

The abdomen is narrow and meager, sunken, with projecting thoracic crests, soft, somewhat tender on the right side of the epigastrium under the curvature without rigidity, no tenderness on M. Burney's spot. By palpation entele splash is found the idith of feet fingers lower than the umbilicus. Temperature 37.2° pulse 140.

October 3d Immediately after admittance the patient given two pint of saline hypodermatally, and, on account of great restlessness, hydrochloride of morphia (5 minims) later every other hour camphor oil and caffeine (hypodermatally). Broke down rather suddenly and died about eight hours after admittance.

Autopsy Oct. 24, 1913 (30 hours post mortem). The body is good deal box middle height lean, and very meager. Face sunken neck long, with thorax extremely long. The acute epigastric angle abdomen not distended.

The left lung where the upper part no certain signs of tuberculosis. The organs very anemic. There is no fluid in the peritoneal cavity. By inspection of the opened abdomen nothing is seen of the small intestines as the whole space is filled up

by the stomach, the duodenum, and the cecum. The stomach is exceedingly distended. The greater curvature lies somewhat lower than the umbilicus. It contains in the enormously distended duodenum. There is a twist of the viscus of the mesentery common to the small and large intestines, so that the part of the intestines which lies between the inferior part of the duodenum and the right half of the transverse colon (both included) takes part in the twist, which amounts to 35X360°. The direction of the twisting is the same as the movements of the hands of a clock (screw with left hand thread). The transverse colon runs dorsally to the duodenum and the stomach. The right part of it is not provided with omentum, whereas all its omentum extends from the weaker greater curvature upwards and back, and is the left part of the transverse colon. The sigmoid flexure is very long and lies all the way over on the right side behind the twist.

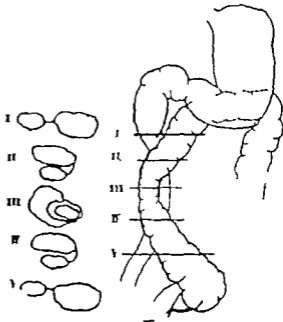
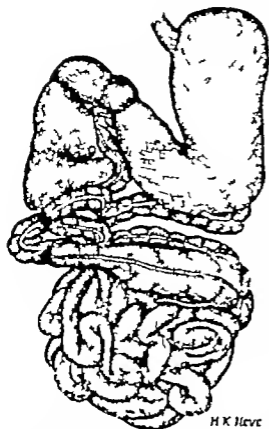
Corresponding to the torsion fibrous adhesions are found between the duodenum and the ascending plus the transverse colon, upwards towards the first part of the adhesions become stronger and of more fibrous character.

When now to obtain detorsion, torsion is performed screw with right hand thread of 35X360° the detorsion so far succeeds, as the duodenum now runs a straight course and both upwards and downwards the duodenum lies most centrally behind this the mesentery, with the superior mesenteric vessels are situated, and hindmost the large intestines. But the relations on the middle part of the straightened screw are furthermore complicated, as part of the ascending colon has risen centrally in front of the duodenum having performed a twist of more than 360° as a screw with right hand thread. The said part of the large intestines is by firm fibrous adhesions fixed to the right side of the duodenum and its mesenteric attachment. In this region the duodenum thus runs through a tunnel formed by the mesentery and the large intestine and it emerges from this tunnel in such manner that the normal conditions of the duodenojejunal flexure are brought to mind. The straightened screw is about 4 cm long.

Numerous fibrous streaks are found in the mesocolon corresponding to the ileal flexure, the descending colon and the sigmoid flexure. Similar streaks, but fewer in number are found in the mesentery.

The specimen is kept in the pathological anatomical institute of the University of Copenhagen.

The conditions under which such a torsion may take place are. There is a common ileo-



ileocolic mesentery and the development of the mesentery has stopped at a very early period of the embryo. According to Hæver and Toldt, as early as the fifth or sixth week the physiological twisting of the intestinal canal begins. That part which is the territory of the mesenteric artery, the latter inferior part of the duodenum, jejunum, ileum, caecum, ascending colon and about half of the transverse colon. Just the part which in the above mentioned case has been drawn into the torsion. While the natural development takes place in such a way that the loop is twisted into a screw with a right hand thread the twist in this case has taken place in the contrary direction producing a screw with a left hand thread. By this the duodenum lies centrally to the colon. The superior mesenteric artery, which is to lie in the mesentery between these two parts of the intestines must run dorsally to the duodenum.

According to Wilm's twisting, in most

cases of ileocolic mesentery take place with torsions in this direction out of 50 cases collected by Gallun 35 were twisted in a screw with a left hand 15 in a screw with a right hand thread. Instead of the expressions prevailing in literature with or contrary to the un- with or contrary to the movement of the hands of a clock - one ought as emphasized by Gallun and von Thun, to use the expressions screw with a left or a right hand thread which prevents misunderstanding.

It is very rare that the torsion reaches such extreme degrees as in the case described here Kuljabko Korezki (quoted after Zoega von Manteuffel) in 1897 published a case in a Russian paper in which there were four twistings of a large part of ileum plus the caecum plus the ascending colon but this case is quite isolated and Wilm is referring to it that a twist of only  $2 \times 360$  would be something quite unusual four entire twists are unimaginable. Excepting the case I have in my investigation of the literature not succeeded in finding any twist larger than  $2 \times 360$ . The statement of the degrees of the twist are however oft vague. In the case I am referring to we have considered the position of the vitelline loop before any twist

whatever — physiologically or abnormally — has set in) as a starting point for the measuring and have thence calculated the torsion in degrees.

The peculiar position in this case of the ascending colon which was noticed after the part of the intestines involved in the torsion was twisted  $21 \times 360^\circ$  backward was undoubtedly of much earlier date than the first mentioned twist. What favors this opinion is that the adhesions here were much firmer and that the upper part of the duodenum and the stomach and caecum as well were so much distended. Supposing that the twisted intestine are twisted further  $270^\circ$  (i.e. imitating the physiological twisting) a picture is produced providing a most striking likeness to the norm: the caecum lies in the right iliac fossa, the ascending colon runs upward and to the left ventrally to the duodenum. The fact that the transverse colon runs behind (i.e. dorsally to) the stomach is due to the enormous distention of the stomach which must sink ventrally to the colon as this is flexed to the posterior wall of the peritoneum by the ileocolic structure. But the resemblance to the normal relations is only superficial at the crossing point every fixation of the intestines to the posterior wall of the peritoneum is omitted. Yet it is possible that we are dealing with a fatal anomaly that the vitelline loop actually performed the physiological twisting and formed a plica duodenojejunalis but the evolution was stopped at this point and the fixation to the posterior wall of the peritoneum was omitted. The fact that the duodenum emerges behind the ascending colon (or perhaps the beginning of the transverse colon) instead of behind the middle of the transverse colon is not without analogies. Zuckermandl has seen the duodenum pass through the mesocolon in many distal proximity to the caecum.

In opposition to this hypothesis stands another that the referred position is of intra-uterine origin as sequel of the formation of adhesions by the previous attacks which undoubtedly were volvulus attack. The problem is the same as by the congenital retro-position of the colon inasmuch as that word has been used for intra-uterine torsions by per-

sistent foetal types of the mesentery. In actual retro-position coli of congenital origin has been found with absolute certainty only in four cases (Tscherning, Leopold, Meyer, Strehl, Rovsing) though it may be most probable that the phenomenon has been overlooked in other cases.

A great deal of work has been done in drawing schedules about the abnormalities in the development of the mesentery and about the different types of volvulus (Zoege von Manteuffel, Liebm, de Quervain). The attempt at grouping such findings have led to the drawing up of complicated schedules. It is of the utmost importance to know the formation of the intestinal tract, as it is the only way in which it is possible to understand the origin of these cases, which must be reckoned under suppressed growths. The physiological twisting of the vitelline loop may be omitted totally or may take place in an abnormal direction or degree. The fixation of the mesentery of the duodenum and the colon to peritoneum parietale respectively to omentum majus may be incomplete as seen in the case referred. Very seldom gaps are found in the mesocolon through which the coils may pass (Liebm). It is most interesting that we observe in the anatomy of animals mesenterial types congruous to the human foetal types (Kraut).

Clinically the pictures produced by the anomalies of the mesentery are of course very different. A common ileocolic mesentery with omittance of or defects in the physiological twist may by chance be found at a post mortem examination (Tscherning, von Thun) where the torsions as a rule will produce severe symptoms. According to the localization of the torsion and the degree of the occlusion we will have symptoms of ileus of a higher or a lower type complete or incomplete. Generally the patient is taken suddenly ill with severe pains in the abdomen, vomiting and prostration in many cases the symptoms appear in connection with violent exercise. Sometimes here is a difference in the intensity of the pains, as the patient lies on the one or on the other side. Occasionally circumscribed meteorism can be seen. Contrary to this acute onset is the course which

as a rule is prolonged a duration of eight to ten days is by no means rare

Just as it frequently is possible to ascertain that the patient formerly has had similar attacks, which have passed away without operative treatment, so remissions during the single attacks may frequently be observed remissions during which the patient's general state of health is better status is passed and the local meteorism disappears (Boyd, Martin-Reid). In other cases the course is rapid and death occurs within twenty four to forty-eight hours. In such cases a larger segment of the intestines, by the post mortem has been found involved in the torsion and both the intestines and the peritoneum have contained plenty of blood (Blecher Burgess) — so much so that the bleeding has been considered the cause of death. Kraft looks upon the thrombosis of the mesenteric vessels as the main cause of death, while others lay greater stress on the paralysis of the sympathetic or on the intoxication from the stagnated contents of the stomach and the intestines (Wilms). The question is difficult to decide but it is natural to suppose that the stated facts appear in mutual strength. The diagnosis is difficult — in most cases all but impossible to make except as a surmise. In some cases a local meteorism may perhaps give a clue. The quantities of fluid that can be injected into the rectum may give a hint as to the localization of the volvulus. The prognosis is generally bad as a rule it is at a very late stage that the patients are brought under treatment and they and their medical attendants are deceived by the frequently occurring remissions and experiences from former attacks may tend toward the same. Partly in consequence of this partly too, because the operation in these cases often is difficult the prognosis must be bad. A case like the one in question even had it come under treatment much earlier would have presented very great difficulties as to orientation.

The ideal treatment is detorsion, but it must be combined with a prevention of recurrence. The latter is prevented by fixation of the intestines to the wall of the abdominal cavity (Braun) or by plastic operation on the mesenterium (Senn). In many cases, however it is impossible to untwist, partly on account of firm adhesions, partly on account of distention of the intestines therefore it is often necessary to begin by an evacuation of the contents of the intestines (Moynihan, Rovsing). If the detorsion is not successful after this operation there is the choice between primary or secondary resection anastomosis operations (short-circuiting or an evulsion of the screw by an anastomosis on either side of it) or the making of an anus preter naturalis.

In some cases it has been considered more advantageous to operate in several sittings for instance to begin by evacuating the stagnated contents of the intestines, and then some hours later to try a detorsion (Wilms). But so many conditions are to be taken into consideration that it is hardly possible to draw up concise lines for surgical intervention.

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## TUBERCULOSIS OF THE KIDNEY WITH ESPECIAL REFERENCE TO ITS DIAGNOSIS

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THOUGH it may be said by many that the literature upon the above subject is already voluminous nevertheless, to my mind, it constitutes a fertile field for thought and study inasmuch as the value of the means for positive diagnosis is just beginning to be fully appreciated and understood. The past history of this disorder bears eloquent testimony of the evils of the faulty and inert means of diagnosis which were at the disposal of the conscientious physician, and the urgent need for the present day helps which we have in our possession, in the form of an advanced knowledge in regard to abdominal diagnosis, the cystoscope, the microscope, and the estimation of renal activity which is demonstrated by the phenolsulphonephthalein and indigo blue tests. The early and positive diagnosis of the condition is of paramount importance from the standpoint of both patient and physician, the patient being spared hopeless extensive infection, with its attendant suffering and mental anguish and the physician often gaining considerable renown for his alertness and skill. During the past few years the realization of the dangers of delayed recognition of this exceedingly important urologic condition has resulted in a well defined tendency to seek new agencies of greater refinement and exactness and accordingly ideas and instruments of precision have undergone extensive revolutionary changes.

In view of the fact that the means of diagnosis which we have at our disposal at the present time are of fairly recent development, a brief résumé of their principal points of interest might not be amiss considering the fact that but a small percentage of the profession understand their application. The use and technique of the microscope is or should be known even to the physician of the smallest hamlet so that a description of this instrument might be considered superfluous.

The history of the cystoscope dates from

1805 when Bozzini of Frankfort conceived the idea of illuminating the urethra and bladder as a means of diagnosis. Naturally this original instrument was of crude construction and possessed disadvantages which were to be overcome only by further investigation and experimentation. The efforts of Bozzini were, however, not without results, for the interest of other investigators in the line was aroused, and a decided stimulus to their energies was received. Furstenberg, Creuze, and Bruck followed, each with instruments more refined in character but it remained for Nitze and Leiter combined with the advent of the incandescent lamp of Edison, to produce an instrument of somewhat practical value. As it is to day cystoscopy is an essentially practical procedure which the investigators of the past quarter of a century have developed, and it is evident that the McCarthy modification of the Brown-Bueger cystoscope will very materially influence the finer points of diagnostic importance. Not only is this instrument admirably designed for revealing the character of the interior of the bladder but it also constitutes the finest example of an instrument for posterior urethroscopy now on the market. Although admirably suited for general work, it nevertheless is an instrument which can only be fully appreciated by men of superior technique, with an accurate knowledge of the regional anatomy such as is possessed by its designer. For ordinary work, however, it is doubtful whether any other instrument possesses as many useful and practical qualities as the plain examining cystoscope of Nitze with the Zeiss system of lenses and corrected image. As to size, the No. 15 F is to be recommended, as it may be used with equal satisfaction in either the young nullipara or in the case of the largest urethra.

Although it must always be borne in mind that the object of cystoscopy is to examine the

bladder and that it is not done for the purpose of catheterizing the ureters unless clinical and urinary evidence point to ureteral or renal involvement, the condition under consideration presents a typical indication for ureteral catheterization unless a vesical tuberculosis exists which is held by many authorities as always associated with and secondary to a renal infection. In this case the tuberculous lesions about the mouth of the corresponding ureter are usually so suspicious that a further search is often uncalled for and men of no small moment do nephrectomies in such cases even in the absence of all other symptoms, and after repeated failures to find bacilli in the urine.

Ureteral catheterization in these cases often presents difficulties, in the presence of a turbid fluid medium or an inability to clearly locate the ureteral orifices, due to the difficulty experienced in sufficiently distending the bladder on account of a coexisting tuberculous cystitis, yet if the normal location of the ureteral orifices be continually kept in mind by comparing the floor of the bladder to the dial of a clock and thinking of the opening of the right ureter as corresponding to seven o'clock, and the left to five o'clock, much will have been accomplished.

It is a matter of prime importance that the testing of catheters be always carried out before using them and that they be washed out immediately afterward as the embarrassment of finding them plugged, and the necessity of their withdrawal for cleaning after they have been introduced may thus be saved. Ureteral secretion is never normally continuous but is always interrupted periodically appearing in dribbles consisting of ten or twelve drops. It may thus be seen that should a kidney after being catheterized suddenly secrete a large amount of turbid white urine while the other displays a secretion normal in amount there exists a renal retention on that side and one may infer that there exists a pyonephrosis associated with a renal destruction of considerable extent. The rapidity of the urinary flow from each ureter should also be noted yet the extent of the renal involvement cannot always be estimated by this means alone as

several cases are recorded in which the diseased organ secreted as much as four times the amount secreted by the healthy one, and yet had been almost totally destroyed. It will be found however that the specific gravity of the urine in the cases is very low. Occasionally cases are encountered where thick pus finds its way through the lumen of the catheter and deposits itself in the test tube in a semisolid mass. This is always indicative of a non-functionating kidney, the presence of an organ which has been converted into a fibrous pus sac, or to the existence of a perinephritic abscess.

As the technique of the introduction of the cystoscope and its use are so fully and vividly described in the treatise on cystoscopy of either Squier or Plicher the reader is referred to these excellent sources for his information on these points.

In the condition under consideration, the point of utmost importance demanding the attention of the diagnostician is the ability to determine the activity of both organs, especially that of the unaffected one, as much depends upon the findings as to the method of treatment to be undertaken by him. It is folly to perform a nephrectomy unless there is present in the kidney to remain an amount of normal renal tissue corresponding to at least one third of the total renal tissue when in good health. It is here, then, that the functional renal tests are called into play. Much could be said in regard to the efforts of the early investigators to satisfactorily solve the question as to the best means to be adopted to determine to just what degree the renal cells were carrying on their work in comparison to the normal but it remained for Rowntree and Geraghty of Johns Hopkins Medical School to simplify the procedure by the introduction of phenolsulphonephthalein as the coloring agent, and for Hellige to introduce his colorimeter for the accurate estimation of the degree of excretion. The test, though easy to perform is nevertheless but little known to the profession as a whole consequently a few words as to its application and the method of estimating the quantity excreted by the use of the colorimeter might be of value to some.

The patient's bladder should be completely emptied and exactly 1 ccm of the phenol-sulphonaphthalein solution from an ampoule injected into the lumbar muscles. At the end of an hour from the time the urine rendered alkaline first shows coloration the entire contents of the bladder should be collected and the amount of phenol-sulphonaphthalein excreted, accurately estimated. This is accomplished by first filling the wedge-shaped cell with a standard solution made by diluting exactly 1 ccm of phenol-sulphonaphthalein solution, from an ampoule with about 200 ccm of water adding 10 ccm of a five per cent solution of sodium hydroxide, or its equivalent, and sufficient water to measure one liter. Place the filled cell in the colorimeter. Dilute the specimen of urine to about 200 ccm with water and render alkaline by adding 10 ccm. of a five per cent solution of sodium hydroxide, then further dilute the alkaline urine with sufficient water to make it measure one liter. Enough of this solution should be perfectly clarified by filtration to fill the rectangular cup to the mark that will be found upon it. The cup and contents are then placed in the apparatus and the latter manipulated until the colors, as seen through the prism, are identical, when the percentage of excretion will be directly indicated on the scale. If after adding the alkali, the coloration of the specimen is slight, showing small excretion of the phthalein then the dilution should be carried only to 250 or 500 ccm and the readings on the scale divided by four or two as the case may be. Again at the end of the second hour another such collection and examination should be made. Used as a differential test, the secretions of the kidneys should be separately collected by ureteral catheterization for one hour from the time the urine from either side first shows discoloration.

As stated above it is usual for the injection to be given intramuscularly yet Furness of New York has used, and continues to use the intravenous route. Although requiring additional care and special attention to asepsis, he is enabled to produce more rapid elimination and exactness,—results which are extremely desirable to the physician performing this test as an office routine.

The following constitutes the picture presented by the cystoscope and colorimeter in the average case demanding the attention of the physician. As previously stated, tuberculous cystitis is associated sooner or later with renal involvement, in approximately seventy per cent of the cases, especially in males and in cases where there is marked involvement of the trigone *tenuis* forms a very prominent symptom, making the introduction of the cystoscope a very difficult procedure, and entailing the patient considerable pain especially in those cases of the neuroathenic type. The sphincter muscle is therefore, markedly contracted, and offers considerable resistance to any form of instrumentation. Necessarily there is some traumatism, followed very often by hemorrhage and it has been asserted by excellent authority that cystoscopy occasionally gives rise to traumatism that is sufficient to act as a predisposing cause of vesical tuberculosis, where the bladder has been free from involvement in cases of renal tuberculosis until after examination. After washing the bladder several times if necessary to obtain a clear fluid medium, the fundus, walls, and trigone should be carefully examined. Usually the superior and posterior walls show no involvement, the trigone especially the region surrounding the ureteral orifices, displaying the most marked evidences of the secondary infection. This consists in the presence of yellowish white milium tubercles surrounded by a congested zone. Some will be seen to have broken down into ulcers which are either single or multiple show more or less infiltration according to duration, have thin elevated edges, and irregular outlines. They are usually of small size and are frequently surrounded by other groups of milium tubercles. The remaining mucous membrane is usually more or less congested, and may exhibit varying degrees of contraction, due to a frequently coexisting pericystitis emanating from an outward extension of the inflammation.

Having carefully examined the bladder the next step consists in catheterizing the ureters and the pelvis of the kidney. The catheter is introduced further in the instrument until

its tip is seen to be slightly beyond the ureteral orifice in the field of vision. The deflector of the cystoscope is then manipulated until the catheter is directly over the ureter mouth. The catheter is inserted into the ureter and pushed on up into the renal pelvis. As in the case of the bladder ureteral tuberculosis is in all cases a secondary descending process from the kidney unless arising from contiguity and consists, as in other regions, in the formation of miliary granulations affecting the mucosa. These granulations coalesce and undergo ulceration as the disease progresses, and it is not uncommon for the lumen of the ureter to be entirely obliterated, as more or less infiltration takes place. It is evident, therefore, that the ease of ureteral catheterization in these cases depends directly upon the duration and extension of the disease under consideration. Occasionally a case will present itself in which the passage of the catheter is an impossibility, and it must always be borne in mind when it occurs, in conjunction with typical evidences at the ureteral orifices, that there is a possibility of the ureter having been converted into a mere fibrous cord as a result of the deep-seated infiltration. Consequently there is a varying degree of impediment to the urinary flow on the affected side and as the occlusion becomes more marked, a pyonephrosis develops as a result of the back pressure together with a dilatation of the ureter behind it or the renal pelvis, and considerable atrophy of the kidney. These cases occasionally present the characteristic colic of nephrolithiasis or Dietl's crises as a result of the passage of masses of debris from the kidney through the narrowed lumen, and it is therefore wise for the physician to be guarded in his diagnosis of nephrolithiasis and movable kidney as an operation or autopsy performed later may reveal the true nature of the case.

As the catheter enters the renal pelvis an amount of urine, depending on whether or not a retention cystitis is seen to emerge from the catheter mouth, which should be collected in a test tube for future examination. The urine is of low specific gravity and resembles that obtained in cases of interstitial nephritis and it is often no easy task to differentiate

the two conditions from each other by the urinary findings alone especially in the early stages. At this juncture, this will suffice as to the urinary findings, which will be taken up in detail when describing the condition in the kidney.

We have now arrived at the kidney in which tuberculosis occurs as frequently as in all the other genito-urinary organs put together. The infection is always a secondary one as the disease has manifested itself elsewhere in the body previous to its appearance here or else it is a part of a rapid general constitutional infection. It is usually possible to elicit the history of an existing renal congestion prior to the advent of any tuberculous infection, and it is this congestion which presents a favorable predisposing factor in arresting the passage of the tubercle bacillus through the urinary tract, after it has reached the kidney by either the haematogenous or lymphogenous routes.

As in movable kidney females in the third decade of life furnish the majority of cases seeking the advice of the physician. The right kidney appears to be more susceptible than the left, which will seldom become involved if its fellow is removed at a sufficiently early date. Two varieties are encountered the miliary which is characterized by the presence of miliary tubercles scattered throughout the renal tissue and the caseating which is characterized by the presence of cheesy nodules surrounded by fibrous tissue and a slight nodular enlargement of the organ. These nodules may be either single or so extensive as to entirely destroy the organ converting it either into a fibrous mass or a useless shell.

In case both kidneys become involved due to the procrastination of the patient in seeking medical advice or to a delayed diagnosis it is very frequent for different phases of the infection to be presented by the two kidneys. This is, as a rule due to the difference in the duration of the disease or to the presence of a mixed infection in the one and a simple tubercular infection of the other. They may therefore exhibit a non-suppurating caseous degeneration on the one side (pyelonephritis) and a suppurating caseous degeneration on

the other (pyonephrosis). The kidney showing the suppurative process always produces symptoms of a more acute character due to the greater activity of the pus producing organisms present and the consequent higher degree of inflammation which they produce. This one is always the larger of the two and is the one which is the most distinctly palpable and tender upon external examination of the loin.

As to the symptoms presented those of a reflex character are often the most pronounced the bladder playing such an important rôle that the cystoscope becomes a diagnostic instrument of necessity. Vesical pain and tenesmus associated with frequency of and burning on urination and frequent absence of local pain often mislead one and point to vesical conditions and many a case has gone to an untimely grave because of delayed diagnosis and consequent treatment being wrongly applied. Pain and tenesmus, however, are not so marked unless a very high grade of inflammation exists in close proximity to the sphincter as in trigonitis. The frequency of urination is noted both during the day and night, and besides being associated with a distinct polyuria, is more marked than in the ordinary case of chronic cystitis and the same may be said of burning on urination. The local pain when present, is located in the loin and is usually of a dull character unless the renal process is very acute and the congestion very pronounced. The temperature of these patients follows very closely that presented by the average case of phthisis pulmonalis and mixed infection is usually announced by the ushering in of sweating and chills.

If the urine presents typical indications of the disease which in many cases it does not, the urinalysis chart may usually be depended upon to give evidence directly in relation to the stage of the progress of the disease. Thus a chart usually read as shown herewith.

Tubercle bacilli are usually not found in the average urine until the appearance of pus, and unless a specimen is stained with carbol fuchsin and later treated with alcohol the *Mycobacterium tuberculosis* which is morphologically almost identical with the tubercle bacillus,

	Stage of Inflammation	Stage of Development	Age of Lesion
Amount	Increased	Decided Increase	Increased
Specific gravity	Varies (1.020)	Low	Low (1.010)
Color	Light	Very light	Very light
Reaction	Acid	Acid (slightly)	Alkaline
Albumin	Trace	Trace	Varies dependent upon the reaction of the urine
Leucocytes	Present	Occasional	Present
Erythrocytes	Present	Present	Occasional
Epithelia	Renal epithelium present	Renal epithelium present in small amount	Renal and vaginal
Casts	Glycine	Glycine	Epithelial casts of renal pelvis
Bacteria	None	None	Traces of bacilli and cocci
Fungi	None	None	Present

may be mistaken for it. In case no bacilli are found after two or three examinations, guinea pig inoculations should be resorted to that a valuable time may not be lost.

Hematuria constitutes another very frequent symptom of renal tuberculosis, and has been compared to the hamoptysis appearing in the pulmonary form of the disease. The hemorrhage is not induced by jarring and motion of the patient, as is the case in nephrolithiasis, but very frequently occurs suddenly without any apparent cause disappearing in the same manner. It is of the terminal variety and the blood is as a rule thoroughly mixed with the urine although cases are not infrequent in which it is passed in the form of long slender ureteral clot. Hematuria, in one sense of the word, presents the most important objective symptom of the disease in that it may be the only indication of its existence before secondary infection has taken place and suppuration begun. It behooves the physician therefore to always think of the possibility of an existing renal tuberculosis in any and all cases applying for treatment, in which hematuria exists as the only or most prominent objective symptom.

Although I personally do not fa or the use of the tuberculin test due to the fact that it has been conclusively proven that an old

encapsulated lesion may exist and yet usually give a negative result. It nevertheless is used by several. It must be borne in mind by those using it, however, that a minimum dose only should be employed as the maximum dose may give rise to a febrile reaction even in health.

It is now that the phenol-sulphonephthalein functional test should be employed and the relative activity of each kidney accurately determined. The solution is withdrawn from the ampoule as described in the foregoing instructions, and a tourniquet is placed about the arm to cause the veins at the bend of the elbow to become more prominent. It should be remembered at this point that a mistake is often made by applying the tourniquet too tightly as by so doing the arterial supply to the forearm is interfered with or cut off entirely thus defeating the purpose for which it was employed. The needle of the syringe is then inserted into the median basilic vein, the tourniquet removed and the solution slowly injected into the circulation. Previous to this time the cystoscope has been removed from the bladder permitting the ureteral catheters to remain within the ureters. The ends are then placed in test tubes, which contain a five per cent solution of sodium hydrosulfide, and held securely by means of a Friedman combined cystoscope and test tube holder to merely determine the time necessary for the phthalein solution to appear. If this method is not employed, the urine is collected and the percentage of phthalein excreted by each kidney determined by means of the colorimeter as previously described.

This dissertation was written with the idea in mind of enumerating the main factors which should be considered in the diagnosis of renal tuberculosis and of describing some of the means of diagnosis which have been developed during the past few years and not to dwell at any length upon the differential diagnosis, yet one would not be justified in ignoring this side of the subject entirely. Accordingly those diseases for which tuberculous kidney is frequently mistaken may at least be mentioned in passing. The condition which resembles tuberculous kidney more than any other is nephrolithiasis but this may

usually be clearly differentiated from it, if one is careful in considering the history which may be elicited from the patient. The other conditions to be considered are movable kidney, cystic kidney, renal tumors, hæmorrhagic nephritis, and suppurative diseases of the kidney arising as a result of obstruction to the flow of the urine, and as a sequel to acute nephritis complicating the infectious diseases.

This brings us to the treatment, which may be summed up in a few words, and should be considered from an hygienic, dietetic, medical and surgical standpoint. No matter what course is decided upon as being the wisest to follow no time should be lost, since the patient will die of cachexia and uremia, in approximately three years after the first appearance of its typical indications, if the disease is permitted to pursue its own course.

Unless it has been demonstrated that both kidneys are involved, and that insufficient normal renal tissue exists to properly carry on the work required by the entire economy, the hygienic, dietetic, and medical treatment should never be employed, except in very rare cases. If the case has been properly diagnosed before both kidneys have become involved this expectant treatment is but a waste of time and energy since it has been conclusively proven by such men as Rovsing, Senn, Squier, Willy Meyer, von Bergmann, Kronlein, and Guterus that the surgical treatment of this condition is the only one holding forth any ray of hope. As to the surgical treatment, nephrectomy constitutes the procedure worthy of the most consideration and has proved to be one of the most successful operations of major surgery.

Concely the nephrectomy should embody a free incision,—placing the ligature before the removal of the clamp to minimize the dangers of hæmorrhage—removal of the ureter as low down as possible and a thorough cauterization of the stump as complete a removal of the fatty capsule as is feasible in order to lessen the liability of leaving behind a disease focus, and careful attention to the wound closure that the possibility of a future sinus may be lessened as they are most resistant to all forms of treatment, and tend to retard the convalescence of the patient.

## CONCLUSIONS

1 Ureteral catheterization is uncalled for when the tuberculous lesions about the mouth of the ureter are typically suspicious and present difficulties on account of the frequently coexisting tuberculous cystitis.

2 Ureteral catheters demand scrupulous care in cleaning and should always be tested before introduction.

3 A nephrectomy should never be performed unless an amount of normal renal tissue corresponding to at least one third of the total renal tissue when in good health is present.

4 Vesical and ureteral tuberculous infection is always secondary to the renal condition.

5 Care should be exercised in diagnosing nephrolithiasis and movable kidney as a colic similar to that occurring in these conditions may arise from the masses of debris which pass through an infected and narrowed ureter.

6 Interstitial nephritis and renal tuberculosis may easily be confounded with each other if the urinary findings alone are depended upon for diagnosis as the two conditions resemble each other very closely especially in the early stages.

7 Tuberculosis occurs in the kidney as frequently as in all other genito-urinary organs put together. The right organ, in females in the third decade of life, furnishes the majority of cases.

8 Reflex symptoms are most pronounced, vesical symptoms usually predominating and often pointing in this direction as the seat of the trouble.

9 Tubercle bacilli are usually not found in the average urine until the appearance of pus.

10 Renal tuberculosis should always be thought of in any and all cases in which hematuria exists as the only or most prominent objective symptom.

11 Nephrectomy is the most successful operation in the realm of major surgery and offers the only satisfactory means of dealing with this condition unless both kidneys are involved or insufficient renal tissue exists. The expectant treatment is but a waste of time and energy in the early diagnosed case.

If I have succeeded in arousing interest in this class of cases, have stimulated your mind to further investigations and have clearly demonstrated the numerous advantages and necessities of the latest methods of diagnosis I shall feel that the purpose of this paper has been well accomplished.

## OPERATIVE TREATMENT OF ANEURISM OF THE AORTA

BY H. KUMMEL, M. D. HARKER-SPENDOR, CHICAGO

THE operative treatment of aneurism of the aorta has thus far been limited mostly to operative procedures affecting the disease indirectly. I recall Brador's operation, the ligation of the subclavian and carotid for the treatment of aneurism of the thoracic aorta, with its different modifications. Gatsch's method of placing a thin band of aluminum 2 cm. wide around the distended abdominal aorta and Hahstedt's method, which consisted in cutting strips from the aorta of a dog and applying them spirally to that of another dog. Matas and Allen attempted to narrow the thoracic aorta by making folds in its walls. They used this method successfully on a number of dogs and believe that it can probably be used on man. MacEwen and others inserted a needle into the sac of the aorta and scratched the posterior wall in order to clot the blood. Rupert, Collins, Braine, Hartnell, and others laid bare the abdominal aorta and inserted a long thin wire. These are examples of the different methods for the treatment of aneurism of the aorta that have been used in animal experiments and on man and many others could be added to them.

Tuffier operated on four patients for aneurism of the thoracic aorta by the following method. He made a temporary resection of the left anterior wall of the thorax over the second and third sternocostal cartilages under positive-pressure anesthesia, located the beginning of the normal lumen of the aorta at the boundary of the aneurismal sac, clamped off the latter with a forceps especially made for this purpose and resected it. This was followed by double suture by Carrel's method. One patient lived 17 days, one died from secondary hemorrhage resulting from infection, one from hemorrhage and in the fourth case the operation could not be carried out.

So far as I know the direct operative treatment of an aneurism of the thoracic aorta that had already ruptured has not

been performed or at any rate only very rarely so that the method used for this purpose ought to be of considerable interest.

The 5-year-old patient was admitted to the medical section of our hospital for an aneurism of the thoracic aorta 12 years before he had taken treatment in New York for syphilis. He left the hospital of his own volition and returned a few weeks later on account of increasing pain and a tumor that suddenly appeared on the left side of the back.

The patient who appeared to be suffering complained of keen pains irradiating toward both sides of the back and toward the lower extremities, as well as of a painful swelling on the left side of the back below and upon the costal arches. This had recently been developing gradually. The patient showed a pulsating tumor as large as two fists to the left of the spinal column reaching from the crest of the pelvis up over the costal arches. The palpation, which, as synchronous with the radial pulse involved the entire tumor which seemed to be covered only by the skin. The diagnosis of a ruptured aneurism of the aorta was not difficult. The roentgen picture gave no accurate information as to whether the aneurism was above or below the diaphragm, as the shadow was very diffuse. As the patient was getting weaker all the time and death as certain from hemorrhage we made an attempt to save this rather hopeless case by operation.

The plan of operation was to lay bare the aorta as much as possible retropleurally and retroperitoneally and after compressing it to remove the sac and close the opening in the artery by suture. Therefore several ribs (the fourth to sixth) were resected, the spinal column, care being taken to spare the pleura, and a large enough opening produced in the wall of the thorax so that the hand could easily be inserted. The pleura, which was somewhat thickened, was not injured, so that it, as not necessary, to use the positive pressure apparatus that was held in readiness. The pleura was pushed forward and the thoracic aorta laid bare without difficulty. I know this region very well from having performed several operations for carcinoma of the intrathoracic portion of the oesophagus, and I have often been surprised in this operation to find how easy it was to dissect the circumferential oesophagus from the aorta, provided the case was operable. The aorta, as now laid bare without difficulty as far as the sac of the aneurism which was found to be above the diaphragm. A rubber tube was laid under the thoracic aorta in order if necessary to utilize it for temporary closing of

the artery. We did not have to use it but produced the necessary compression with the fingers. The thoracic aorta was compressed between the thumb and index finger of a assistant at the diaphragm and the upper boundary of the pulsating tumor that was now covered only with a thin skin. The an of the aneurism was laid bare with a long incision, the tear which was already present enlarged, and masses of clot removed. I order to be able to see the lower part of the normal aorta at the edge of the sac, we split the diaphragm and laid bare the upper part of the abdominal aorta retroperitoneally so that there was free view of the field of operation including the thoracic and abdominal aorta and the sac of the aneurism. The sac of the aneurism was larger than the sac and the original tear in it was 1 cm long. I passed my index finger into the normal lumen of the aorta above and below the aneurism from the inside of the sac and trimmed the latter so that vessel corresponding to the normal lumen of the aorta was formed. The aneurism had caused bulging chiefly of the posterior wall of the aorta, and had left the part of the artery lying immediately behind the spinal column comparatively unaffected. The 1 cm long slit, the new formed aorta, that was now freely exposed was closed with continuous suture and the digital pressure somewhat relaxed. A little blood still emerged from some places, a second continuous suture was applied over the other without any special difficulty. During the compression the blood pressure had risen to double its normal height from the exclusion of the greater part of the circulation.

The digital compression of the aorta had lasted about 15 minutes. As it was gradually relaxed and finally withdrawn altogether the suture was found to be sufficient. Not a drop of blood issued from the line of suture. The pulsation both femoral as strong and the pulse at the brachial plexus could be distinctly felt for ten minutes. We observed the suture man while keeping the wound dry and found that it was firm and tight. The time of the operation was unnecessarily increased by the postponing of the opening of the sac that was contemplated first. The wound as then closed the pulsation in the lower extremities was good. The operation had taken about 1 hour and after its completion the patient was in comparatively good condition. He was able to be turned to the left that he was paralyzed by the intravenous administration of ether and the heart was kept strong by the continuous influx of salt solution and ether. But he gradually grew weaker and weaker and finally died of heart failure.

From my numerous successful experiences in suturing the aorta and other vessels, which have been previously reported, I believe that the tendency of the vessel to heal is relatively great and that suturing them is not technically so difficult as is ordinarily supposed.

In the specimen a great cavity can be seen which the aneurism had produced, and a shallow depression that it had made in the bodies of the vertebrae. The double suture of the aorta 10 cm long can also be seen. Looking at the specimen from the inner side of the aorta it can be seen that the suture has reestablished almost a normal condition of the vessel, and that the one place where there is still a little pouching out could easily have been overcome by a few deep sutures, which hardly seemed to be necessary at the time of operation.

Though this case was not successful, as the patient died of exhaustion, yet it seems to me to be significant and instructive for future cases of operative treatment of aneurism of the aorta. It shows that it is possible to lay bare the aorta retroperitoneally and retroperitoneally which overcomes a great part of the danger of pneumothorax arising from opening of the thorax. It shows, moreover, that the ruptured sac can be removed under digital compression of the aorta, an almost normal vessel created and firmly sutured and that other measures for strengthening the suture could very well have been carried out.

I would recommend that the line of suture be covered with a broad strip of fascia which should be fastened with a few fine silk sutures to the vessel wall. This would increase the time of the operation only a little and would markedly increase the protection of the suture.

It is to be hoped that this operation may be carried out successfully in similar cases of aortic aneurism.

DYSMENORRHOEA ESSENTIALIS<sup>1</sup>

BY THEO J. DOEDERLEIN, M. D. CHICAGO

IF one bears in mind that, according to Tobler and Engelmann 50 to 80 per cent of our American girls are affected with dysmenorrhoea, that this affliction not only is the source of great pain and discomfort, recurring periodically with clockwork certainty but also reduces the economic value of so many working girls the importance of careful study and investigation is brought home to us. Why it is that American girls are subject to this disease in greater number than their European sisters is somewhat problematical as many of our working-girls come from Europe where they enjoyed good health. If we remember however that our country really was the pioneer in giving to women employment in professional as well as business lines which entails greater responsibilities and more concentration of mind and application to duties with total disregard for the weaknesses and disabilities womanhood behest to we may in a way explain this greater prevalence.

There was a time when all pelvic pains accompanying menstruation would be called dysmenorrhoea. It is well known that all pathological conditions in and about the adnexa and uterus may become intensely troublesome during menstruation. Thus simple tubercular and specific salpingitis, oophoritis of all types, myomata of the uterus, either by pressure or obstructing the outlet, old peritonitis and appendicular inflammation may become greatly aggravated during menstruation. This should be no reason why one should at the time of menstruation change the nomenclature of these conditions. We have other painful conditions remote from the pelvis such as sick headache, neuralgia, stomach disorders, etc. which in a person subject to them may become more conspicuous during menstruation with absence of pelvic pain. We would not think of calling such pain dysmenorrhoea. It is obvious to me that the term dysmenorrhoea really meaning difficult menstruation

should be restricted to a certain syndrome of symptoms of specific character that, in other words it is a well-defined pathological entity and has a treatment entirely distinct from that of other diseased conditions of uterus and adnexa.

The symptoms, all of which are well known but usually not grouped and interpreted as belonging to essential dysmenorrhoea are the following:

1 *Gradual development.* The age of puberty is not as a rule the time dysmenorrhoea first appears. Usually it begins with gradually increasing severity a few years after menstruation appears. Of importance is the fact that it ordinarily appears in virgins who never were exposed to the danger of pelvic infection. It is moreover significant that in girls who practice sexual relations dysmenorrhoea is rarely found. If anything this would establish the non-inflammatory nature of the disease.

2 *Type of pain.* A few hours to even a day before the beginning of menstruation a lancinating colicky pain radiating from uterus to back sets in. Occasionally the pain does not appear until flow is established. Often the pain is most agonizing, the patient lying in bed with flexed knees, pinched expression associated in most cases with headache, nausea and vomiting.

3 *Intermenstrual freedom.* With most pelvic diseases the woman is more or less conscious of continuing trouble during interval while a characteristic of essential dysmenorrhoea is the entire absence of symptoms during interval. Such girls may enjoy any outdoor sport or physical work, usually productive of aggravation or recurrence of symptoms due to inflammatory disease without the least after effects so far as pelvic condition is concerned.

4 *Sensitiveness of uterine mucosa.* It is a well known fact that the mucosa of the healthy uterus is not very if at all sensitive. Per contra passing a sound into the uterus or

even very slightly touching the cervical mucosa of a dysmenorrhoeic uterus produces great pain. In fact very often nausea and vomiting, headache and faintness develop in the same manner as at the oncoming menstruation. Repeatedly I observed this in my patients. Patients would tell me "This is precisely the pain experienced during menstruation." Especially sensitive is the region of the internal os and cornua of the uterus. I often noticed that the slightest touch of the os externum would be keenly felt by the patient who did not know I had a sound in my hand.

5. *Mittelschmerz*. This peculiar phenomenon I desire only to mention in so far as it is pathologically and clinically analogous and explanatory of dysmenorrhoea. Perhaps some of us have seen this rare condition in which exactly in the middle of the interval a pain occurs of dysmenorrhoeic type disappearing without further symptoms. Gottschalk calls this condition a synchronous ovulation the ovary having a dense capsule with difficult and painful rupture. More corroborative of our view in the question of essential dysmenorrhoea: Veit's explanation befall it middle ovulation, the endometrium not being sufficiently hardened *aufgehockert* to respond with depletion. Veit cites a most instructive case of a 30 year-old woman who would have the typical *Mittelschmerz* pain during one interval while in another she would have a bloody flow for a day without pain.

6. *Discharge of membranes*. This lead us to the subject of membranous dysmenorrhoea which really is part of the study of the etiology of essential dysmenorrhoea. I believe that membranes are much more frequent than is usually supposed, that the extent to which the mucosa is destroyed varies within wide limits in different persons and even in the same person at different periods of life. That if we carefully examine menstrual discharges, we can, in the majority of instances, find proof of exfoliation of the superficial layer of uterine mucosa varying from small shreds made up of a few mildly hydropic stroma cells to complete coagulation necrosis, and exfoliation of endometrium.

It would be of value but beyond the scope of this paper to go into the microscopic study of the uterine mucosa during the entire menstrual cycle which as is known, consists of the quiescent, the constructive, the destructive and the regenerative stages. Suffice it to say that the stroma which in the stage of construction has become oedematous to jelly consistency with wide capillary tracts during the stage of destruction becomes haemorrhagic by diapedesis, due either to its large or as Young maintains, a dragging out of cell by osmosis. Young's theory in his own words, is as follows: There is an active dragging out of cell by a crystalloidal element which brings about an osmotic pressure discrepancy between the protoplasm of the stroma and the blood in the vessels, to readjust which an outflow of fluid takes place from the lumen of the vessel into the stroma cell. These hemorrhages form lacunae in the stroma often large and diverting pushing aside the stromal cells and lifting off the superficial compact layer before it has time to become vascularized or as Schoenberg put it, *aufgehockert* until the blood finally has found its way into the uterine cavity either by way of glandular openings or by breaking through the surface epithelium. Considering this physiopathological process we can readily understand the frequent appearance of shreds in the menstrual discharges. But to revert to the point at issue I wish to say that if shreds and membranes so often are discharged during painless menstruation why should the discharge of membranes, the condition known as membranous dysmenorrhoea be the cause of pain rather than the etiological factors of essential dysmenorrhoea. Very interesting observations have been made by Heap and Van Herwerden on monkeys and apes with regard to painless discharge of menstrual membranes to consider which would lead too far. In my opinion, it seems certain that the discharge of membranes often a symptom rather than a cause of dysmenorrhoea just as we have membranous colitis of neuropathic or as some maintain toxic origin.

7. By some observers, endometritis is regarded a symptom of dysmenorrhoea. There

undoubtedly may be an endometritis concomitant with dysmenorrhoea, but I would by no means believe it a symptom. We have seen that the destructive stage of the menstrual cycle simulates a severe endometritis to perfection except that a complete restoration *ad integrum* follows immediately during the stage of regeneration leaving nothing pathological but the highly sensitive mucosa. If anything, we might designate this a non-inflammatory physiological endometritis produced perhaps by the ovary elaborating an increased amount of that biochemical substance called hormones which, in turn, produce this increased determination of blood to the uterus. Many observers examined large numbers of menstrual membranes (e. g. Olshausen, 61) only an average of 68 per cent showed signs of disease of the endometrium.

We will now briefly take up the various theories of etiology in their chronological order. The older observers invariably upheld the obstructive theory. Thus Marion Sims made the statement "Nulla dysmenorrhoea nisi obstructiva." Dr McIntosh claimed twenty four cures out of twenty seven patients by dilatation and was an ardent adherent of the theory of mechanical obstruction to outflow. On reasoning a little his cures may readily be explained.

Schauf distinguishes an organic congestive and neuralgic form.

Gusserow describes ovarian and uterine dysmenorrhoea as also the mechanism of the latter regarding anteversion important.

Olshausen finds two causes for acute angular anteversion and obstruction namely (1) hypoplasia and infantilism (2) premenstrual swelling of mucosa and endometritis.

Gebhart Theilhaber and Victor Schulze maintain that the pain is due to pressure within the uterus. The first believes that pain is produced by increased destruction of mucosa oedema, stretching and pressure on uterine nerves the second by a spastic contraction of circular muscle fibers of the internal os analogous to pylorospasm the last explains dysmenorrhoeal pain by capsular tension "Kapsel-pannungsschmerz" which is premenstrual and he regards it due to presence of connective tissue in the layers of

infantile uterine muscle, and contraction pains, "Webenschmerz," which is menstrual and the expulsive effort of the uterus.

From these theories which in the main are formulated on a mechanical basis, there is a transition of modern authors to nervous theories, of which I found Vedeler to hold the most extreme views. He designates dysmenorrhoea the stigma of hysteria. A more conservative view is taught by Menge, who believes in an underlying uniformity of etiology for all types namely a neuropathic condition of the patient magnifying pains which given a normal nervous system, cause little or no discomfort.

Kronig and Velt seem to hold the *aurea media* admitting the possibility of the presence of a neuropathic hypersensitiveness with little or no apparent local disturbance but firmly maintaining that there are many cases in which local conditions are productive of the violent pain.

There are, as we observed various types of dysmenorrhoea. We find cases in which the anatomical element is predominating the patient being a pale weak and nervous-appearing girl, with infantile uterus and elongated cervix, anteversion and perhaps retroversion of uterus. Then we have cases in which the neuropathic or psychopathic element is in the foreground, the patient, usually a robust, well nourished girl having a well developed uterus with little or no misplacement.

Although there undoubtedly is one underlying cause for all types of dysmenorrhoea, it might be of advantage as far as the management and treatment is concerned to classify the various cases according to their most conspicuous features.

Those cases in which the anatomical element is closely associated with and very likely a sequel to, a neurosis I would designate as the anatomiconeurotic type. This class recruits its members out of the ranks of shop and office girls and students. This class of girl apply themselves with great intensity to their work and studies, and in these cases the general invalidism is secondary to long continued mental and physical fatigue and, as is now believed by some observers, a

toxaemia arising from the thyroid gland a tubercular focus or coprostasis.

In the second class of cases, the psychoneurotic type anatomical changes are conspicuous by their absence. The girl is healthy and robust-appearing with well developed genitalia. This type is found especially among people in affluent circumstances and society girls possessed of an excitement and pleasure seeking mania and girls of an inherited neurotic tendency. We could also include in this class the dysmenorrhoea produced by long-continued repression of sexual instinct. We know that at the age of puberty dysmenorrhoea is practically never met with. The girl up to that time leads a fairly natural life and develops symmetrically. Later on, her mother's daily warnings and corrections, social conventionalities and her own studies induce her to repress her sexual instincts, which gradually produces lessening of sexual feeling or even a stamping out of sex. I remember in this connection a university student of the highest literary attainments who bewailed the fact that her ardent sexual feeling at the age of seventeen was so radically suppressed by sheer power of will that now at the age of twenty five she regarded herself as practically sexless. She had passed through a condition of dysmenorrhoea and had been amenorrhoeic for the last two years.

Most observers agree that girls, who seek to gratify their sexual feeling by conventional contact with the opposite sex, as in games, walks, drives, and dancing, not speaking of those who practice illicit relations rarely are affected with dysmenorrhoea.

Thus I would say that neuropathy and idiosyncratic tendencies play an important rôle in the production of essential dysmenorrhoea, but that local anatomical and physiological conditions deserve equal consideration.

Our present state of knowledge of biochemistry and also our clinical experience do not warrant the assumption that the remote cause of all types of dysmenorrhoea is a toxaemia as I have heard mentioned.

The treatment concerns itself with two phases the curative and the preventive.

The preventive involves a difficult sociological question, which could not be considered in this paper. The curative treatment is general and local. The general treatment, besides hygienic diet, and tonics, may consist in the administration of tuberculin or thyroid extract, the latter recommended and described by Dalce. For local treatment the intra-uterine stem-pessaries of the Watkins or Dickinson type have met with some favor. I have used them in a number of cases with rather indifferent result. Dilatation and systematic sounding in my hands have been most successful. I use a male urethral sound No 13 or No 14. The main object to my mind of pessaries or sounding is blunting the hypersensitive mucosa, and not dilatation as was formerly believed.

Treatment of the attack consists, first, in relieving congestion. This is done by hot applications, hot sits baths and hot douches. Secondly by relieving severe uterine contractions, for which the well known hydragric, viburnum, and opiate are used.

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CALCIFIED FIBROMA UTERI COMPRESSING THE SIGMOID COLON<sup>1</sup>

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**CASE HISTORY.** Mrs. C. A. Y., married, 7 years old, consulted me August 3, 1912. In her early married life patient gave birth to two children, both of whom died in infancy. Menopause at 43. Her family physician, Dr. J. I. Esch, of Daytona Beach, Florida, reported that for a period of about thirty years patient had suffered from repeated attacks of pelvic pain, also of colitis. All of these attacks were treated medically. For the past two years patient has complained of rectal pain and tenderness with inability to move the bowels without a preliminary colonic flushing. She has lost thirty-five pounds in weight during the past year, this being at least in part, due to the marked restriction in diet which the patient imposed upon herself in order to lessen the number of bowel movements.

On examination patient does not present the appearance of cachexia. A cataract of the left eye has been present for several years. Examination of the genitourinary system reveals a high degree of arteriosclerosis. On palpating the abdomen, a hard tumor the size of an orange can be felt in the left lower quadrant. It is only slightly movable and is painful when moved pressure upon the sigmoid was so atrophied and rectal tenesmus so pronounced that examination was unsatisfactory. The cervix could be palpated but it was unable to identify the fundus. Pressure from above the tumor mass caused slight movement of the cervix. The rectum was contracted and very tender and both internal and external hemorrhoids represent a tentative diagnosis of carcinoma of the sigmoid was made and an exploratory laparotomy advised and accepted. Patient entered the Ravenswood Hospital August 1, 1912, and as operated on August 3, 1912. Under ether narcosis I was able to introduce a Kelly proctoscope for a distance of six inches before meeting any resistance. The lumen of the bowel appeared normal. The hemorrhoids were rapidly removed prior to opening the abdomen. The peritoneum was opened through a left rectus incision. When this was done the tumor was found directly over the left side of the pelvis, the lower uterine segment being elongated and atrophied. From the fundus an intense mass emerged a sessile calcified fibroid the size of a range which rested upon the sigmoid and was adherent to it over an area of four inches. The adhesions were broken up, the denuded area on the sigmoid covered in by running catgut suture and supra-sagittal hysterectomy performed.

The colon was somewhat thickened both above and below the site of compression, but no lymphatics could be palpated. Normal saline was given intravenously while closing up the abdomen as patient was in profound shock. She remained in critical

condition for three days, but made a slow and uneventful recovery, leaving the hospital three weeks from the date of the operation.

Her physician wrote to me on December 19, 1912, reporting gain of six pounds and freedom from her former marked constipation, but his patient was still subject to the same syndrome of arteriosclerosis, dyspnea, and tachycardia on exertion. No further report was received from the patient or family doctor until February 1914, when Dr. Esch reported that the patient had been sinking rapidly and that he had lately been able to palpate a tumor mass in the left side of the pelvis. She died a few days later, no post mortem being obtained.

From the foregoing history it is reasonable to diagnose the case as one of intestinal compression caused by the calcified fibroid, with secondary carcinoma of the colon. In view of the subsequent history it is probable that carcinomatous infiltration of the sigmoid was about to take place, or had already occurred, at the time of the operation. Resection of the sigmoid was, however, out of the question, the patient being in an extremely precarious condition through out the operation.

The gross specimen which was exhibited before the North Shore Clinical Society in November 1912 and which has since that time been in the hospital laboratory was that of an atrophied uterus with a markedly elongated—almost pedunculated—lower uterine segment having attached to its posterior wall and fundus a totally calcified sessile fibroid measuring 10x8x6½ cm. and weighing with the uterus 750 gm. The surface which lay on the sigmoid was totally denuded and had the appearance of a small mass of coral rock, the balance of the calcified fibroid was covered by a thin layer of tense connective tissue which also held it firmly to the uterine fundus. No sections were made, because as above stated, the specimen disappeared and could not be found again.

**Historical.** It is interesting to record the fact that Hippocrates, in Book 5, Chapter 12, mentions calcified fibroids of the uterus. Roux, in France, discovered the origin of these

tumors in 1809 and Meckel in 1818 recorded their clinical characteristics.

**Frequency** A review of all the cases reported to date forces one to the conclusion that calcification is the rarest of all the degenerations which uterine fibroids may undergo. Inasmuch as the tendency of the times is to diagnose and operate upon uterine fibroids much earlier than has been the custom in the past, it is reasonable to presume that "womb stones" will in time, become an almost unknown curiosity. The clinical history of my patient for example, would tend to show that she had suffered from her fibroid for a period of thirty years or more, but no diagnosis of her condition had ever been made prior to 1912 because all of her attacks of "pelvic peritonitis" had been treated symptomatically without an adequate preliminary examination.

While realizing the futility of attempting to present exact percentages, the sum total of the cases reported within the past ten years gives us, I believe, fairly valuable data. Of the combined cases of uterine fibroids which came to operation reported by Werner (1) Ludlow (2) Ellise McDonald (3) Scharlieb (4) Tracy (5) Dorsett (6) and Noble (7) — 6496 in all — 181 or approximately 3.5 per cent had undergone calcareous degeneration. J. T. Everett (8) was able to find only 33 authenticated cases reported in the literature from the days of Hippocrates up to the year 1879. In 1901 Gullb  (9) had increased the number to 81 and added four more observations, making a total of 85. A Bernardie (10) in 1911 reviewed Gullb 's 85 cases and added four more. Since the publication of Bernardie's thesis, in 1911 I have been able to find reports of only nine additional cases, among which one or more of Dorsett's and of Werner's cases may have been included in previous statistics. The cases of Nadel (11) Poucher (12) and Lewers (13) as well as my own case, must be added to Bernardie's total. It is, therefore, certain that there are less than two hundred authentic reported cases of calcified fibroid in the literature.

**Pathological anatomy** Approximately 79 per cent of all calcified fibroids are either interstitial or subserous, the latter variety

being slightly more common. The so-called "womb stones," i. e. calcified fibroids lying free in the uterine cavity, are found in 13 per cent of all cases. In all probability they represent interstitial fibroids whose blood supply has gradually become occluded and having undergone calcification, produce pressure necrosis of the adjacent mucosa and finally drop into the cavity of the uterus. The calcareous fibroids lying free in the abdominal cavity such as those reported by Dorsett, in which case the unattached stone was wedged in between the bladder and rectum by Harris (14) in which the mass lay in the pelvis adherent to two loops of ileum but devoid of blood supply by Walther (15) in which the stone was completely detached from the uterus and adherent to the mesocolon and by Lewers, in which the tumor lay in Douglas' pouch — are all pedunculated fibroids whose pedicles had gradually atrophied and become absorbed. Pearce (16) states that calcification of an intra uterine pedunculated fibroid is very rare, because its blood supply remains adequate. Nevertheless Keiffer (17) reports the history of a patient 61 years old who had been repeatedly cured for metrorrhagia, with the removal, by the curette, of many small calcified fibroids. She finally submitted to a laparotomy. Sarcomatous degeneration of the uterus was found at operation with metastases in the abdominal wall. The patient succumbed to sarcomatosis.

**Chemical composition** Calcified fibroids are essentially composed of phosphates and carbonates of lime. Ammonium or magnesium phosphates are rarely present, — a point of diagnostic importance which will help to differentiate them from vesical or renal calculi. Bernardie gives the following percentages: tri basic calcium phosphate, 85 to 90 per cent; carbonate of lime 5 to 15 per cent; sulphate of lime, 0.05 to 1 per cent.

The macroscopic appearance varies greatly depending principally on the progress of calcification. This, in the vast majority of cases, begins centrally. Dudley (18) reported the removal of a calcified subserous fibroid which consisted largely of a thin hard crust which felt so much like a foetal head, even to

the sutures and fontanelles that he at first hesitated to open the abdomen. Withrow (19) removed a subserous fibroid from a 50-year old patient, which consisted of a fairly smooth calcareous shell one fourth inch thick, containing semi-solid pulpy material. In Lewers case the completely detached tumor consisted of a calcified shell containing hyaline material. Bernardie states that after the shell is formed the enclosed fibrous tissue may gradually become infiltrated by calcareous granulations, or may even completely atrophy thus forming an empty shell. It is self-evident that once the calcareous shell is complete no further blood-supply can reach the fibroid and its contents must necessarily undergo some form of necrobiosis. In the central or common type of calcification the process begins as a deposit of phosphatic granulations the size of a millet seed. These tend to coalesce and spread peripherally somewhat like a spider's web. This depends on the fact that the calcareous deposits primarily occur in the immediate vicinity of the fibrous septa along which the blood vessels pass. These calcified radiations may gradually coalesce forming ultimately a compact, extremely hard tumor of white or whitish-yellow color. Should the stroma entirely disappear the tumor loses its granular aspect on section it is smooth polished, and resembles eburnated osseous tissue.

"The whole arrangement of the fibrous septa and capsule may be reproduced in the lime salts. More commonly the spaces between the septa do not calcify but disappear by some other degenerative process, giving the calcified part a porous, worm eaten or coral-like appearance. — Dudley (20)

The denuded area of my specimen was whitish-yellow in color and lobulated. Under a magnifying glass one was forcibly reminded of a series of mole-hills. On striking it against a solid body it gave the flat sound of a solid stone and was extremely hard. There was no capsule over the posterior superior portions, but the fibrous septa and the remains of the capsule held it firmly to the fundus uteri.

Bernardie states that "in a few rare cases genuine bony formation takes place, with bone-cells and a primitive haversian system

Thorne (21) found an oblong tumor of stony hardness attached to the pubic arch and forming part of the anterior bladder wall. It was the size of a hen's egg and one of the calcified areas consisted of bone-cells. The location of this tumor makes the possibility of its being a vesical calculus at least suggestive. A chemical analysis might have cleared the diagnosis. From a purely histological standpoint, it is hard for me to understand how genuine osteoblasts could appear in a degenerated fibroid. Nevertheless, Cornill (22) declares that ossification of calcified fibroids is exceptional, but may occur.

*Histology* There is always a stroma of muscle and connective tissue fibers containing calcified plaques. The first change which takes place is the gradual disappearance of the muscle-cells, which are replaced by connective tissue. The latter then becomes infiltrated by deposits of lime salts (phosphates, etc.) In the final stage the blood vessels become obliterated the organized elements lose their structure undergo necrobiosis, and form an amorphous stroma in which microscopically no anatomic details remain.

*Age* The youngest patient was 33. This is Thorne's case which as previously stated is of somewhat doubtful origin. Dudley's patient was 35. With these two exceptions, all of the cases whose reports I have been able to study were those of patients well past the menopause.

*Pathogenesis* The exact biochemical changes necessary for the calcification of a fibroid are at present totally unknown. The single factor which stands out prominently in all of the carefully reported cases is that of cardiovascular disturbances. Arteriosclerosis of the uterine arteries is essential to calcification. Analyzing the cases of uterine fibroids reported by Webster, Boldt, and Fleck to which list he added several occurring in his own practice Doane (23) brought out the fact that an average of 38 per cent of all cases showed marked cardiovascular changes. A contributing factor is suggested by Sampson (24) who studied the blood-supply of uterine myomata. He states that there are frequently no veins in these tumors, and that at best, they are never as abundant as in the myome

trium. This condition would naturally favor stasis and tend to produce regressive changes.

As a result of this twofold circulatory disturbance degenerative changes—hyaline fatty or waxy—take place in the fibrinoid. The necrobiotic tissues contain phosphoric acid fatty acids and certain proteid having a special affinity for calcium. Absorption being deficient—even absent—the calcium salts in suspension in the blood come in contact with the phosphoric acid and are precipitated as tribasic phosphates. Ludlow states that

the calcium salts are held in solution or in suspension by the proteid either a carbonates and phosphates or as calcium ion proteid compound—perhaps both. This suspension is in an unstable condition possibly only because of the extremely small proportion of calcium in the blood (1 to 1000).

Bernardie ingeniously theorized the following:

Arteriosclerosis always present nutritional disturbances manifested especially by an excess in the blood of organic and inorganic substances especially calcium salt. These poorly soluble salts, being in excess in the blood are readily precipitated. In the fibroid local vascular changes lessen the blood supply and thus bring about a real dehydration of the cellular protoplasm. As a result of this dehydration the carbonates and phosphates of lime are present in oversaturated solution in the protoplasm and are precipitated in the form of minute granules which rapidly coalesce. Arteriosclerosis thus plays the principal rôle in calcification of fibroma because—

(1) It causes nutritional disturbances.  
(2) It brings about local circulatory disturbances favoring a dehydration of tissues and precipitation of inorganic salt. The process is identical with that observed in chronic gout or in arthritis deformans.

Neither Ludlow nor Bernardie has taken into consideration the fact that in order to regress to the point of calcification the fibroid must remain aseptic. In the presence of infection—from the colon bacillus or other pathogenic bacteria—the capsule or serosa is invaded and further changes, other than those due to bacterial infection, become im-

possible in other words, calcification only progresses so long as the tumor remains aseptic. This probably accounts, in part, for the rarity of calcified fibroid.

*Clinical symptoms and diagnosis.* Inasmuch as calcification of a fibroid is a slow biochemical process, there are only two factors which may bring about subjective symptoms that can be considered as pathognomonic of the change. These are (a) increase in the weight of the tumor and (b) displacement of the tumor due to its increased specific gravity and also in all probability to a decrease in size with atrophy or disappearance of its pedicle. In reviewing the comparatively few careful reports in the literature one is sorely struck with the fact that a majority of these patients sought relief from some rather odd complication having previously suffered in years from a mild degree of compression phenomena. Acute intestinal obstruction, anuria or dysuria, peritonitis, perforation of the uterus (Léon et Lagasse [5]) are a few of the phenomena which may lead to a correct diagnosis. The ordinary train of symptoms common to fibromata need not be discussed in this paper.

It seems probable however that the complication of a calcified fibroid comes on more suddenly and with greater intensity than do those of ordinary fibroma.

On physical examination the stony hardness of the tumor and its nodular surface should arouse our suspicion. If in addition one can get a crackling sensation on compression of the tumor or crepitation caused by its friction against the pelvis, the diagnosis becomes positive.

Radiography has so far been very little used but should be of in valuable aid. The spontaneous expulsion of "camb stones" at their removal by curettage are very rare occurrences. Hallopeau and Raymond (26) while palpating a hard tumor the size of a fetal head obtained a crackling sensation which they correctly interpreted as being due to incomplete areas of calcification, allowing the calcified areas to rub against each other. Walther obtained a sensation of friction and crepitation by rubbing the tumor against the promontory of the sacrum, which enabled

him to make a correct diagnosis. It remains a fact however that a majority of these cases are correctly diagnosed at the time of operation.

Among the rarer complications to which calcified fibromata may give rise perforation of the rectum, blocking of the small intestine, perforation of the bladder, occlusion of a ureter leading to fatal hydronephrosis and compression of the iliac vessels on one side leading to edema and even gangrene of a lower extremity may be mentioned.

**Prognosis.** As a rule this is not good. Occurring as they do in patients suffering from more or less serious cardiovascular disturbances, the removal of these tumors is a poor surgical risk. Neither does their removal have any beneficial effect on the cardiovascular system, the changes in the heart muscle and vessel walls already being permanent. Nevertheless the sudden complications which are so apt to occur make immediate operative interference imperative. Pignard (27) analyzed eighty-one cases and found a mortality of 31 per cent.

**Treatment.** This may be summed up in a few words: abdominal upravaginal hysterectomy with or without drainage depending on the acuteness of the complications or presence of infection.

#### CONCLUSIONS

Uterine fibroids may undergo calcareous degeneration, especially the subserous and interstitial varieties. These changes almost invariably occur after the menopause; hence the grave complications arising from increased weight and displacement of the tumor occur late in life.

It becomes self evident therefore, that the doctrine that the menopause is nature's cure for fibroid, is a mischievous tradition — Giles (28).

The early diagnosis and removal of uterine fibromata before regressive changes have occurred will insure the best prognosis and give the lowest operative mortality.

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## TRAUMATIC PAROSTEAL BONE AND CALLUS FORMATION

## THE SO-CALLED TRAUMATIC OSSIFYING MYOSITIS

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**I**N the years which have elapsed since Copping (1) in 1740 and Freke (2) in 1741 first described bone masses within the muscles, such formations have continued to excite interest. During the succeeding one hundred and fifty years only occasional case reports and dissertations were published, but towards the close of the nineteenth century when the discovery of the X-ray made possible diagnosis without operation and the enactment of workmen's compensation laws gave a new importance to all occupational injuries, the number of these publications greatly increased so that the literature now contains more than five hundred reports of muscle ossification following trauma. Although the multiplicity of reported cases has robbed the subject of its novelty the interest in its many unsolved problems has not lessened.

The subject also has a very practical application since the number of reported cases is no index to the frequency of the affection. Where ossification is not extensive where its location is such that it does not seriously interfere with function, the condition often is not brought to the attention of a physician even when a physician is consulted, failure to employ the X-ray or to interpret its revelations correctly frequently results in a mistaken diagnosis finally not all cases in which a diagnosis has been made nor even all of those in which an operation is performed find their way into the literature. Machol (10) who made a special study of the relation of posterior dislocations of the elbow and their reduction to so-called traumatic ossifying myositis, observed sixteen such dislocations radiographically and found that ossification in some degree followed in each case. From this he concludes that ossification is the usual sequence of uncomplicated reduced dislocations of the elbow. While we may be un-

willing to accept such a sweeping statement, there can be no doubt that ossification following such dislocations is far more frequent than has been believed and that it is a common cause of the unsatisfactory results following reduction.

Traumatic ossification of the muscle is most frequently met with in early adult life and is far more common in males than in females—facts indicative only of the factor which determines ossification, i.e. trauma to which those who lead an active life are most exposed. Ossification following repeated trauma may be classed with the occupational diseases, cavalry men may develop riding bones, infantry men exercise bones. In the muscles of the inner thigh and upper arm respectively. In ossification following a single injury the occupational element also enters in, although it is less obvious—the farmer the shoemaker the football player in short, any one whose vocation or whose occupation brings with it the hazard of trauma is predisposed. It has often been remarked that patients with intramuscular bone formation have unusually well developed musculature, but here, too, we may suppose that it is rather the hazard of the active life led by these people than any real predisposition that is responsible for the ossification an individual predisposition comparable perhaps to the tendency to keloid cicatrization or luxuriant callus formation, is not to be excluded.

The occupational element is also clearly seen in the localization of the bone formations. In football players, cavalrymen shoemakers, farmers in the thigh. In infantry men (following bayonet practice) in the upper arm. Ossifications in the glutes, the recti, the iliac psoas, the pectoralis, the subclavius, the subscapularis, the temporalis, the gastrocnemius, and the thenar muscles have also been reported.

Widely varying theories have been advanced to explain the intramuscular forma-

Case (1) cited on this subject in 1740. Case (2) in 1741. Case (3) in 1742. Case (4) in 1743. Case (5) in 1744. Case (6) in 1745. Case (7) in 1746. Case (8) in 1747. Case (9) in 1748. Case (10) in 1749.

tion of bone following trauma. They may be grouped under four heads: the hæmic theory, the theory of aberrant sesamoid bones, the theory of periosteal origin, the theory of ossifying myositis.

The hæmic theory was first suggested by Sedler (11) who held that the blood which escaped from the ruptured vessels organized and was transformed into cartilage, then ossified. The theory is histologically so untenable (La Pointe (12) styles it a histological heresy) that it deserves no further discussion and has, in fact, never received much support. The influence of hyperæmia and clotted blood has, on the other hand, been the subject of much experimental work and controversy, and the part which hæmorrhage may play in so-called myositis ossificans traumatica has gradually been incorporated in the other explanations.

The theory of aberrant sesamoid bones, fathered by Bard (13) like the hæmic theory has found but few defenders. It assumes that under the stimulus of trauma such bones proliferate and assume considerable proportions.

Graf (14) was apparently the first to advance the idea of periosteal detachment in explanation of the origin of bone in masses, while Berndt (15) has vigorously defended the theory of periosteal dissemination. The former assumed that trauma results in the detachment of periosteal flaps which are drawn into the tissues by the contracting muscles, and there proliferate; the latter supposes that the inner osteogenetic layer of the periosteum reacts to the trauma by a proliferation of bone-cells which then force their way through the outer shell or wander out through a breach, and continue to form bone. Sometimes a more active part is attributed to this cell invasion and it is asserted that osteoblasts and cartilage cells migrate into the muscles, forming nuclei from which ossification proceeds (true dissemination).

Berthier (16) by experiment demonstrated the possibility of periosteal ossification by chiseling bits of periosteum from the bone and allowing the contracting muscles to draw them into a fleshy bed, but the application

of his experiments to the sort of trauma which here comes into consideration is very questionable—severe contusions, sprains, or rupture of the muscle are very different from the action of the chisel. Moreover the resulting ossifications never grew much larger than the original flaps—in marked contrast to the rapid development of the large masses of bone formed in traumatic ossification of the muscles. Marcus (17) experiments in which he attempted to detach the periosteum from the bone by traction on the muscles, were carried out on cadavers. While the difficulty or even the impossibility of detaching the periosteum by traction was demonstrated here too the conditions cannot be said to reproduce those of trauma. La Pointe (12) however asserts that the separation of the covering of the bones into two layers—an external adventitious and an internal osteogenetic—is in reality somewhat schematic at the point of insertion of muscles such as the crural, the vasti, and the brachialis anticus, the periosteal connective tissue here mingling with the connective tissue of the muscle to form a single tissue. Even granted that a fissure in the periosteum may have been produced, he holds that Berndt's theory of periosteal dissemination would still be inadequate to account for the ossifying of the entire connective tissue wool of the traumatized muscle within the very short period of time so often reported, a migration of bone cells active and rapid enough to infiltrate the entire contused area in some cases a distance of more than twenty centimeters from the supposed fissure in the adventitious coat, is inconceivable.

König who obtained his specimen from the cadaver of a woman who died four months after the accident, which resulted in injuries to the spine and head and the development of a bony mass in the thigh, refers to the pushing up of the periosteum by osteofibrous proliferation at the site of the swelling in the thigh, and of an apparent escape of cells into the surrounding tissues. He adds, however that in numerous experiments on rabbits, he succeeded in producing fibrous thickening of the periosteum but that he never succeeded in producing any parosteal ossification. Berndt (15) supposing that the mass which developed

in the thigh of a man of 62 who had been kicked by a horse represented a parosteal callus operated on the twelfth day after the accident. The muscles showed gelatinous edema and indurative degeneration the periosteum was thickened and congested. The mass together with the periosteum and a thin layer of the compacta was removed *en bloc*. On microscopic examination no trace of beginning ossification could be found and there was no round-celled infiltration. The patient made an uneventful recovery but six weeks later a second operation was necessary because of limitation of motion and the development of a hard mass at the site of the first operation. Gelatinous edema and indurative degeneration were again present, but this time a parosteal callus was also found.

One of the arguments most frequently urged against the assumption of a parosteal origin is based upon the development of bone in the free musculature a stratum of apparently normal muscle separating the growth from the normal bone since bone may develop independently of the periosteum it is urged why have recourse to the theory of parosteal origin to explain any parosteal ossification? Will not the theory which explains the pathogenesis of the free bone mass also answer for the adherent one. The supporters of the theory of parosteal origin have held that all these bone growths were at first attached to the skeleton the attachment later being broken or absorbed — an explanation which their opponents have termed forced.

The latter have quite generally maintained that the ossification was distinctly an inflammatory process as shown by the greater or less degree of round celled infiltration reported in many cases the formation of the mass by organization rather than by proliferation as shown by its early appearance in practically its ultimate size and by the acute symptoms sometimes observed. Berndt (15) thinks that this inflammation is due to an infection of hematogenous origin and finds confirmation of this theory in two reports one published by Itzerott (9) in which a bony mass developed in the upper arm which had become red and swollen without assignable cause a slight rise in temperature being

present at the onset, and one reported by Roskowiak (20) in which the entire musculature of the forearm ossified following repeated abscesses.

In this connection it must be remembered that the deposit of bone in such places as lymph-glands, old tuberculous lesions of the lungs, atheromatous ulcers of the aorta, fibromata, etc. is of frequent occurrence, but the process is not necessarily an inflammatory one. Borst (21) discussing the calcification of fibromata — and what he says is of general application, — states that "A peculiar kind of calcification which resembles true ossification may come about in the following manner: the fibrous parenchyma over considerable areas enters together (undergoes hyaline degeneration) and then calcifies *in toto*. It is then separated from the uncalcified tissue in the form of bony trabeculae and traversed by canaliculi, the entire arrangement of which may bear a

strong resemblance to haversian canals. Closer examination shows that the questionable trabeculae here and there merge with the neighboring fibrous tissue and that in spite of the marked resemblance to osseous trabeculae, not a single true bone corpuscle is demonstrable in the ossified parts.

Without doubt true ossification may also take place in fibromata, and that by a true metaplasia of the tissues the connective tissue cell which are enclosed in the ossifying area are transformed into typical bone corpuscles bearing Sharpey's fiber while the fibrous basic substance becomes thickened and homogenous and is finally transformed into true calcified bone matrix the cells then lie in characteristic toothed bone cavities.

Critical study of the literature on myositis ossificans (in many of the reports no detailed microscopical examination is recorded) makes it seem very probable that some of the reports concerned in reality a pseudo ossification — a bone-like lime deposits containing no true bone corpuscles, or a secondary ossification following necrosis and the deposit of lime salts (Lack (22) Sacerdotti and Frattin (23)). It is quite conceivable that either of these processes might follow the bacterial invasion of a muscle or even, as we shall see presently that bone of the type

met with in parosteal callus might be produced following such an infection. But the typical clinical picture in parosteal callus formation is that of regeneration and not of infectious or any other sort of inflammation, and careful examinations in a long series of cases have given no basis for assuming the presence of infection.

Ewald (24) thinks that because these bone formations always develop in the neighborhood of a joint (?) the determining factor is some component of the latter probably the synovia. He made experiments on three rabbits, with negative results, but concluded that his failures might be due to the unsuitableness of rabbits for such experiments, since three control rabbits in whom a luxatio cubiti had been reduced without the injection of synovia also failed to develop any ossification. Fabris (25) injected synovia or synovia and blood obtained both from animals of the same species and from animals of a different species, into the muscles of five dogs but obtained no ossification from this fact he concluded that the synovia plays no part in determining intramuscular ossification. The formation of bone following chemical inflammation (the repeated injection of quinine (Oddi (26)) of iodopon (Mittler (27)) the injection of serum (Bodians (28)) has been reported in the literature. In the first of these there was the repeated trauma from the injection in the last a large hematoma formed. If inflammation is considered the reaction of irritated and damaged tissues which still retain vitality we must admit that inflammation is always present following muscle trauma but if we are to accept the term in its narrower surgical application as synonymous with infectious inflammation is present in but few cases.

During the past ten months six cases of intramuscular ossification have come under my observation and the interest they awakened led to a study of the material obtained at operation and to a review of published work regarding the condition. In reporting my observations and discussing the origin and nature of the new formed bone I am aware that I am treading upon uncertain ground for until it has become possible to

reproduce these parosteal bone masses experimentally and with a certain degree of constancy thus making possible a daily study of their development any explanation of them must necessarily be more or less hypothetical.

In the nature of the injury in the symptomatology and in the radiographic revelations, the cases which came under my observation were very typical of the type of bone formation under discussion, and for that reason they seem worthy of a brief review. Neither the family history nor the personal history up to the time of the injury contains anything pertinent to the discussion in any of these cases and I shall, therefore, refer only to the condition which brought the patient to me.

The first of these referred to me by D. T. A. Burcham of Des Moines, was in a muscular well-developed man of 3 who had been struck in the thigh during a football game. The leg became swollen and numb but was not painful. As the swelling subsided a indurated area was noticed and was treated by rolling massage. Both this massage and deep pressure were painful and the leg could not be bent. A swelling occupied the middle third of the quadriceps cruris femoris and in the deeper structures a hard mass apparently attached to the femur could be defined. The radiograph (Fig. 1) which unfortunately does not show the entire length of the mass) disclosed a long, spindle-shaped shadowed at the upper end, lying parallel to the long axis of the bone and separated from it by a zone of light.

At operation five weeks after the injury a bony mass some 2 1/2 and one half inches in length and two in breadth was found lying in the vastus medialis. Sharp dissection as necessary to free the mass from the muscle of which it appeared to form a part. At one point it was so adherent to the femur over a small area and after it had been pried loose with the chisel the surface of the bone was curetted. Recovery was very rapid. When the patient was discharged from the hospital ten days after operation the leg was still somewhat swollen and motion in the knee was limited although not enough to interfere with walking. A month after the operation a second X-ray was taken and an indistinct shadow was seen at the femur at the point from which the callus mass had been removed. From that time on, X-rays were taken at frequent intervals (Fig. 2) and it was found that the shadow became denser its outlines clearer although it did not increase in volume. The patient eagerly took up athletics again impromptu. A second operation, four months after the first operation, the shadow having remained unchanged for several weeks, a second mass was removed. It

had about the volume of an egg, was encapsulated adherent to the muscle at one point only but firmly adherent at the site of attachment of the primary mass. Recovery was again rapid and uneventful. The knee gradually regained normal motion and six months after his discharge from the hospital, he was again playing the star role in his football team. A radiograph taken nine months after the operation (Fig 3) shows bone scar.

The masses removed by both operations were submitted to Dr. E. R. Le Count of Chicago who made the following report:

There are two pieces of muscle each containing considerable bone. One is 15.5 cm long, 5 and 4 cm in the other dimensions. It tapers at the ends (Fig 4) from the cutting and dissecting away of the operation of the muscles and fascia from the mass to which it was adherent. At one place there is an area (a, Fig 4) 4 by 5 cm in size where the bone in it was chiseled to remove it.

The smaller piece is 8 by 3.8 by 3.5 cm in size and in general way corresponds to the larger mass. A relatively larger part of its anterior is formed by bone (Fig 5).

**Histological examinations.** Sections were examined from segments cut out of each piece and decalcified (Figs 4 and 5) and from a number of pieces in each segment. They do not differ markedly. The chief difference is the presence of an old hemorrhage (Fig 6) in nearly all the sections examined from the larger mass.

If the microscopic examinations had exhausted the material and sections had been secured from all parts of each mass it is likely that much more in the way of evidence of injury would have been found.

The trabeculae of bone vary in width considerably some being as wide as 0.5 mm. When the staining with hematoxylin and eosin is so proportioned, there is found, even in the heaviest trabeculae and those which approach nearest to the structure of compact bone, some bluish staining material in the centers of such trabeculae, remnants of the cartilage in which the bone has grown, remnants which are generally abundant and obviously cartilage, especially so in the smaller and narrower trabeculae.

It is not possible to trace the way in which this bone has grown in all of its details, because the masses under consideration represent the results of a process of growth which went on for a considerable period, and it is extremely doubtful whether any of the changes now present are quite like those which prevailed at a much earlier period. One feature of especial interest is the conspicuous part played by cartilage in the production of these bony intramuscular

parosteal callus growths. Judging by such features as distribution and relation to other structures, its rôle does not differ in any noteworthy details from that which it plays in the endochondral development of bone or in the formation of the so-called cartilaginous callus of healing fractures.

The presence in some of the sections of a long straight, or regular margin to the newly formed bone (d Fig 6) suggests naturally that here the periosteum was not so lacerated at the time of injury but that parts of it remained, membrane like, embedded in or lying about the region of the hemorrhage.

The location of the masses of cartilage both with regard to skeletal muscle bundles and fibers and to the more recently made and older bone indicates on the whole that cartilage was formed first. This is in accord with the generally accepted ideas regarding stages in callus development (A. L. B. Schmidt (29)) but it should not be forgotten that the trauma preceding this callus formation may have so lacerated and dislocated the periosteum that it, too, contributed to some of this heterotopic cartilage.

Many sections were examined for evidence that the production of red blood-corpuscles had begun in these new and adventitious marrow-spaces. None was found. For the most part the marrow-spaces contain spindle-shaped cells in some there are loosely aggregated collections of lymphocytes. Some marrow cavities are large and possess considerable fat, judging by the shape and other features (Fig 7) of the holes from which the fat has been removed.

In the disappearance of the skeletal muscle as it was gradually grown through by bone muscle fibers become separated from the main mass and are found as isolated rounded masses of cytoplasm with centrally placed nuclei, many of them 30 to 60  $\mu$  in diameter. Others are much smaller and resemble the multinucleated cells more commonly met with in chronic inflammation.

From the foregoing it is evident that so far as can be determined the development

Many are quite like those described by Engelmann. These are histopathological variations of the same process, namely, the development of heterotopic cartilaginous trabeculae. Arch. f. path. Anat. u. hist. anat. (1914) 100, especially 100, Plate I.

of bone in these masses of muscular tissue resembles the formation of bone as it takes place in the repair of fractures more closely than it does any other process in which bone is formed. There are many differences in the structures of the cancellous bone, cartilage, etc. in these parosteal masses and the similar tissues in the callus that unites fractured bones when the union is not hindered or complicated by infection extensive comminution inadequate coaptation—when, in other words, normal regeneration and repair take place. Perhaps the chief differences are connected with the arrangement of the various components, bone, cartilage etc. in these intramuscular callus masses, its aimless irregularity as contrasted with the rather definite arrangement in the callus which repairs a fractured bone. Another difference is the relative absence in the masses examined—the parosteal callus growths—of the loosely constructed tissue made up so largely of spindle-shaped cells which early in the process of normal repair of fractured bones constitute so large a part of the provisional callus. This tissue is aptly referred to as osteoid tissue germinal tissue (Kielgewebe) fibrous osteoid tissue etc. Later in the normal development of callus, this early loose connective tissue it may be recalled, contains both cartilage and bone—it serves as a matrix in which bone is formed. As already stated this tissue is relatively scant in these parosteal masses. It is not altogether absent and had the examination been conducted earlier possibly it might have been found more abundant.

The second patient referred to me by Dr L. D. Hew of Rockwell City was a woman of 50, who had received posterior dislocation of the elbow in a automobile accident some six months before the dislocation had been reduced. Almost once and the arm immobilized in the usual manner but both extension and flexion had remained limited. On examination rather long slender masses were found in the cubital fossa pressure upon which raised the forearm. A radiograph demonstrated that both the humerus and the bones of the forearm had clear cut outlines but slender shadow with light attachment to the ulna represented the normal position of the brachialis anticus—typical picture of the most common form of muscle contraction following the reduction of a posterior dislocation of the elbow (Fig. 8).

Some months later the patient was again examined extension was now about 130 degrees flexion 80 degrees. In addition to the limited motion the patient now complained of some pain and of swelling of the forearm and hand. Physical examination and the radiograph showed no appreciable changes (Figs 9 and 10). Operation was refused.

Dr A. R. Hackett physical director at the Iowa State Agricultural College referred the third patient to me and the case is of especial interest because the history suggests a possible predisposition. The patient, aged 25, is an athlete and all his injuries were received on the football field. Seven years ago he was struck over the insertion of the right deltoid, the arm was very sore for a month, then gradually improved, but a hard mass has remained. There is now no interference with motion and the arm is not painful. There is a hard mass on the palmar surface of the right middle finger the result of a bruise and a similar mass at the base of the fifth metacarpal, the result of another bruise received eighteen months ago. At about the same time he was struck over the insertion of the left deltoid, soreness persisted for several weeks and a hard mass remains here too but there is no disability.

Radiographs of the right arm and of the right and left hand are entirely negative, but a radiograph of the left arm shows a shadow just external to the insertion of the deltoid, apparently representing a bone formation or parosteal callus at the external attachment of the brachialis anticus. Its boundaries are hazy as if there are no sharp dividing line between parosteal callus and muscle. At its proximal end the callus formation merges with the humerus. The diagnosis of parosteal callus may perhaps be questioned in this case because of the spur shape and the absence of a zone of light between bone shaft and callus formation, but the clinical history is that of a parosteal callus and the close union with the humerus is readily accounted for by the age of the process—we have only to recall La Pointe's description of the attachment of the muscle to the periosteum in order to understand this fusion. Operation was not advised.

The fourth patient, a blacksmith of powerful musculature, as referred by Dr R. G. Ampach of Colfax. In an attempt to stop a runaway team two months before this blacksmith had thrown his entire weight upon his left foot while the leg was flexed, and had felt something give way in the muscles of the anterior thigh. The thigh was swollen and painful for a few days, these objective symptoms soon subsided but the soreness persisted and the patient was unable to flex his leg. There had been no ecchymosis at the site of the swelling but after a few days an ecchymosis developed in the popliteal space. Three weeks after the accident, the attending physician noticed an induration in the muscles of the anterior thigh, which has grown more marked but has not increased in size. On examination a mass some five inches long and three inches broad was palpated in the middle third of the quad-

neepa extensor femoris, apparently attached to the underlying bone. The X-ray revealed shadow like a cloud of smoke lying above the femur (Fig. 11). At operation a shell shaped callus was found in the vastus medialis. It was loosened from the muscle by blunt dissection and from the femur to which it was adherent only at the lower pole by prying. The inner surface of the callus mass was concave, fitting over the convex surface of the femur and thus bridging the bone accounts for the absence of the zone of light between femur shaft and callus formation. Recovery was rapid and uneventful and his physician reports an excellent functional result.

This specimen was also sent to Dr. Le Coust who reports follow: The largest dimensions of the tissue are 1.5, 5 and 3.8 cm. For the most part it is covered with muscle. It is very firm and contains a shell shaped mass of bone so that one surface is cupped the depression of 1 cm. in its greatest depth being 8 cm. long and 3 cm. wide.

Corresponding to this, the opposite surface is convex and on it (Figs. 12 and 13) are the only suggestions of bone seen anywhere on the outside bluish-gray smooth patches resembling cartilage.

*Histological examination.* Sections were studied from a number of places from two segments removed at points indicated in Fig. 2 and in a general way the conditions are not materially different in the various places examined, nor do they vary much from those previously reported. In some places there is more bone than in others, in some the cartilage is relatively more abundant. Regions of old hemorrhage are present (Fig. 4) separated from the bone by a dense wall of fibrous tissue. The bone is usually heavier close to the enclosing fibrous tissue (Fig. 5). In sections from one portion (Fig. 6) conditions occur very much like those in an epiphyseal-diaphyseal junction like those illustrated for the burrowing capillaries described in textbooks in the accounts of the transformation of the epiphyseal cartilages into bone as it occurs normally.

A relationship between the bone and muscle much more intimate than any previously seen was found in some of the sections (Fig. 7) as in those previously examined the absence of any inflammatory changes constituted one of the most noteworthy characteristics. There is not in any of the macroscopic preparations any foundation for the use of the name myositis.

The fifth patient was a 12 developed lad of sixteen, had suffered forward dislocation of the elbow seven weeks before. There was considerable deformity and motion was limited. The radiograph in addition to the displacement of the bones, showed faint shadow in the cubital fossa (Fig. 8). During an open operation for the reduction of the dislocation, callus mass one and one half inches long, as removed from the border of the brachialis, tissue in which it extended. It was lightly attached to the ulna. Recovery was uneventful and the patient had range of motion of six inches few weeks after

operation. The callus mass was sent to Dr. Le Coust whose report is given below.

This piece of tissue is 4.5 cm. long and from 1 to 3 cm. in the other dimensions. It resembles the terminal two phalanges of a somewhat stiffened finger. One end of it, corresponding to the tip of the finger is quite pointed. The other is almost entirely made up of bone and is an irregularly rounded surface to 5 cm. in diameter. The outside of this has attached to it numerous small strands of muscle and in some places strands of tendon.

*Histological examination.* The structure of the bone is much more dense (Fig. 9) than any previously examined and the trabeculae contain very little cartilage; the marrow spaces little else but adipose tissue.

The sixth patient was a farmer of 30. Twenty two years ago he was kicked on the right elbow by a calf. The arm, which was swollen and painful for a time, gradually returned to normal. Since then however on any unusual exertion of the arm, the elbow has become swollen and tender. Two days before he consulted me he had helped put chains on a automobile and had since had constant pain in the elbow and forearm. Pressure across the joint was tender and small bony mass was palpable in the cubital fossa. The radiograph (Fig. 10) revealed small round shadow here apparently in the brachialis, places near its ulnar attachment. Operation has not yet been performed.

In the constant factor of trauma, in the presence of disappearing hemorrhages, in the formation of bone by the endochondral route, it is easy to recognize the likeness between this intramuscular callus and the callus developed following a fracture, and if these four specimens were considered alone, without reference to other reports, it would seem not difficult to accept for them a periosteal origin—an outpouring of bone-cells through the contused or lacerated periosteum and their growing into and through the overlying tissues, gradually replacing the clotted blood and perhaps necrotic tissue. The intramuscular callus would thus become only another variety of periosteal callus—a periosteal callus developed in the tissues above an imperceptible fracture of the periosteum. With this conception of its origin, inter and intramuscular connective tissue would play but a subordinate part if any rôle be accorded it, bearing essentially the same relationship to the ossification as to the callus of fractured bone.

Cabler (3) says that, contrary to the com-

monly accepted belief the number of traumatic bone formations in the free musculature is to the number of those attached to the bone as three to two and with these statistics the question of periosteal origin assumes a different aspect, for it is difficult to account for the absorption of the periosteal attachment in three-fifths of all reported cases. The theory of periosteal dissemination of periosteal flap



Fig. 2 Case before operation (the entire length of the mass is not shown). The zone of light between callus formation and bone shaft is well defined.

Fig. 3 Case three months after operation. The shadow has assumed definite outlines.

Fig. 4 Case eight months after operation. There is well developed bone scar but no impairment of function.

detachment of ossifying myositis in the sense of an inflammatory process due to an infection or a chemical irritant, are alike unconvincing while on the other hand the marked resemblance to the callus of fractures suggests a reparative process.

This brings us to the question of nomenclature. The term *myosarcoma* so frequently employed by French writers is not applicable,



Fig. 4 Reproduced photograph and radiograph of the mass removed (Case ) at the first operation. Reduced to 1/2 of the original size. The irregular area indicated by a line is here on the side opposite to that shown here this mass has bone on its exterior surface made by sawing it away from the femur. The parallel lines are where material was removed for histological examination.

or at best it is misleading since the suffix *sarcoma* is so commonly taken to signify true tumor formation, and these callus growths differ essentially from a neoplasm in the narrower interpretation of that word while with a broader construction of the term the appellation *myosarcoma* becomes a loose expression



Fig. 5 Mass removed at the second operation (Case ) with radiograph. The irregular region indicated by a line is surface made by chiseling this mass away from the femur. The parallel lines indicate the pieces removed for macroscopic examination.

applicable to many different conditions. Nor does the term *myositis ossificans traumatica* seem a happy choice, for although it takes account of the factor of trauma, it lays emphasis upon the inflammatory instead of upon the reparative nature of the process. Because of the essential part played by trauma, the marked similarity in structure to the structure of the callus of fractured bone, and the impression gained of a regenerative process, I prefer the term *parosteal callus*, the modifier *parosteal* (from Greek *para* = beside + *ostion* = bone) distinguishing it from the callus of fracture formed in and about the broken bone.

The question of the possible significance of metaplasia in the production of these parosteal growths has purposely been left for separate discussion. Borst (21) in speaking of the former over readiness of the scientist to accept a return of the cell to the embryonal type remarks that this view is no longer accepted and that we are now inclined to hold all too firmly to the absolute fixity of cell type. He continues "Examples enough of a transitory or a permanent loss of differentiation may be found in inflammatory regenerative, atrophic processes. Such observations have also been made upon the basis of experimental studies (tissue transplantation). Placed under other conditions, with a changed nutrition, a changed relationship to the nerves, a lack of functional demands, in short — if I may be allowed the expression — with a change of their entire milieu the cells and tissues change their morphological characteristics and also no longer exhibit certain specific functions. But the morphological change does not by any means indicate to us that the nature of the cell has also changed and the failure of certain specific functions to manifest themselves does not demonstrate that the cells have entirely lost these qualities; on the contrary, not infrequently with the advent of normal conditions the original form as well as the specific function is restored."

The action of trauma upon the tissues would seem quite capable of producing a change of the entire environment of the cell, for not only is a changed nutrition brought about but in most cases there is also tem-

porary suspension of function. As a result we have a reparative process with a temporary loss of cell differentiation resulting in the formation of an intramuscular callus.

With the return of normal conditions, the original form as well as the specific function is restored and the growth of the parosteal callus is thus limited by the restoration of approximately the old environment. But metaplastic bone is true bone and is no more readily absorbed than is the latter with the gradual return of the surrounding tissues to normal. The parosteal callus, surrounded by a fibrous capsule — a periosteal covering, we may say — is left within the muscles as an osteoma or attached to the underlying bone as an "exostosis."

This distinct limitation of the period of growth draws a sharp line between parosteal callus and tumor growth (Cahler terms the former a *paraplasia*) and has long been emphasized in determining the proper time for operation. In the clinical picture the tense doughy mass palpated in the first few days after the receipt of the injury represents the blood infiltrated tissues sometimes also a considerable hemorrhage; later the mass loses its elasticity and becomes more distinctly indurated, finally attaining a bonylike consistency as cartilaginous bone replaces the blood clot. The fact that the mass has its ultimate size almost from the first has often been urged in support of the theory of periosteal flap detachment and intramuscular transposition. The detachment and dislocation of such a large flap is scarcely conceivable, while the clinical picture accords well with the conception of a morbid indurative reparative process.

But are the histological findings compatible with our conceptions of connective tissue metaplasia? May metaplastic bone pass through a chondral stage? Such an endochondral origin has generally been held to be characteristic of periosteal bone formation, but recent repeated microscopic examinations of various forms of ossification would seem to make such a dividing line between metaplastic and periosteal bone untenable. Reports of bone formations in the abdominal muscles have been referred to and the possi-



Fig 6 Photomicrographic reproduction of single section. The section is 1 cm long, 7.5 mm wide at the narrow, 1 mm wide at the opposite end. Here the roots are well shown. Starting with the old blood clot ( ) as center there are (b) places where hemorrhage is still present in the zone of granulation tissue ( ) outside of these zones some of bone (d) sharply demarcated on the one edge but uniting very irregularly with the next outermost zone of cartilage ( ) (f) osseous tissue (g) spongy bone (h) skeletal muscle.



Fig 7 An unusually large marrow cavity with many places (round holes) here far forward, as present. Here bone formation is relatively quiescent although nearby all the trabeculae contain cartilage. 30 Dia.

bility of confusion with the pseudo ossification described by Borst has been pointed out. Detailed microscopic examinations of some of the specimens are, however, given and the presence of true bone cannot be questioned. In some of these descriptions the presence of cartilage is specifically mentioned (Ropke [31], Chapelle [32], Sahymlina [33], Strassberg [34]) while in other cases the specimen was removed at a time when the formative period was past, and it was therefore impossible to determine whether bone was formed in a chondral matrix. The presence of cartilage in an ossification of the gluteal muscles is reported by Tubenthal [35].

Konig [18] whose specimen showed bone formed both directly and by the endochondral route, considers the possibility of all the tissues surrounding the bone sharing in the formation of the callus. Frangenhelm [36]

who made a painstaking study of an attached parosteal callus and of numerous ossifying foci distributed throughout the overlying vasti muscles, thinks that only the shell of the attached callus, i.e. the part immediately overlying the bone is of parosteal origin while the remainder of this mass and the scattered foci of ossification are developed at the expense of the intramuscular connective tissue — such development in the case of the intramuscular foci being clearly demonstrable. Orth [37] reports the case of a man of 84 who developed a luxurious callus following a fracture of the femur. The man died a fortnight after the accident and Orth made a careful study of the callus. No internal callus had been formed and a great deal of blood was present in the medulla; the mass consisted of much cartilage and osteoid tissue with here and there finished bone. Callus was present everywhere between the muscle fibers and in part between the muscles. It was possible



Fig. 8. Case 3. Six months after reduction of the posterior dislocation.



Fig. 9. Case 3. Six months later, showing the extent of the lesion.



Fig. 10. Case 3. Labeled as 'Fig. 10. Case 3. Labeled as' in the caption.

to section the material without decalcifying it, thus greatly facilitating the examination. Orth states that while no one now believes in the metaplastic production of epithelium from connective tissue connective substances—particularly connective tissue cartilage, and bone—may merge with each other. He distinguished between cell-metaplasia and tissue metaplasia; in the former the connective tissue cells take on an osteoblastic function forming bone exactly as do the osteoblast of the periosteum; in the latter bone is formed directly from connective tissue fibers. He

believes that the callus in this case was formed from intramuscular connective tissue by tissue metaplasia and, therefore, was not of periosteal origin. In connection with this description of Orth's it is interesting to recall that in many of the reports of parosteal callus,



Fig. 11. Case 4. The swelling of the femur by the callus formation period, as reconstructed, one of their relation (each other and consequent) the zone of light between them is not clearly defined. The cloud of smoke appearance is not clear.

Fig. 12. Case 4. Photograph and radiograph of tissue removed from the fourth patient. Segments taken for microscopic examination indicated by the parallel lines.



Fig. 14 Bone with an old hemorrhage in the adjacent tissue (below). Above here the square is drawn there is hyaline cartilage. This field enlarged is shown in Fig. 6.

especial mention is made of the formation of bone by the direct and by the endochondral route proceeding side by side.

I shall not attempt to determine the respective part played by periosteum and by intramuscular connective tissue in the production of adherent parosteal callus. The conception of ossification proceeding simultaneously from periosteum and from intramuscular connective tissue (Frangenheim [36], König [18]) would seem to have much in its favor; the relative importance of each varying widely under different conditions. It is, moreover, quite conceivable that the metaplastic process extending to the peri-

osteum would undergo a more or less firm fusion with it, or again, that now the periosteum and now the intramuscular connective tissue is involved for with the infinite variations of trauma it is impossible to judge of the exact nature of the injuries to the tissues and to the bone in any given case. Even the origin of the callus of fractures is not uncontested. Macewen (38) and Wetherill (39) hold that the periosteum has a protecting and limiting rather than an osteogenetic function, and offer experimental and clinical evidence in support of their contention. Ryerson (40) also attacks the theory of periosteal osteogenesis and offers radiographic

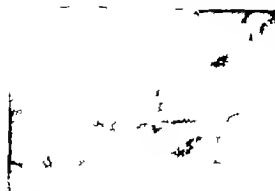


Fig. 2. Case 5. Anterior dislocation of the elbow seven weeks after receipt of the injury. The shadow in the cubital fossa represents callus formation in the border of the brachial artery.

porous. For several weeks the picture continues to change — the shadow grows darker and more homogenous. It shows a figuration stripes and spots, the latter being in turn shaded by the formation of lamellæ which are in part arranged parallel to each other. After from four to six weeks the volume of the mass as revealed by the radiograph corresponds closely to the palpable mass, and it is probable that once this point has been reached no further appreciable changes occur. Radiographs taken six weeks, twelve weeks, and five years after the accident have given the same picture.

While an area of light within the shadow may signify a cyst it may also represent an area of connective tissue or of cartilage. In the same way the zone of light between the callus and the diaphysis to which reference has been made does not necessarily indicate that the callus is free within the musculature; it may have a large or a small pedicle of spongy bone. A broad zone of light does, however, signify the absence of such an attachment.

Under favorable conditions the fine inner markings are an index to the structure of the mass, showing its trabecular arrangement. The strokes of the shading are sometimes parallel to the muscle bundles or to the direction of striping, corresponding to the ossification of muscle bundles or to the deposit of bone lamellæ in the shell-shaped fascia layers.

From the standpoint of differential diag-

nosis, osteosarcoma displaced bone fragments, and exostoses are to be considered. Myositis ossificans progressiva and syphilis of the muscles with ossification are usually readily distinguished from parosteal callus because the course of the two former is chronic, often extending over many years. While sarcoma and parosteal callus often have a history of trauma in common the use of the radiograph should permit of correct diagnosis. — In parosteal callus the shaft of the bone is intact, the new formed bone separated from it by a line of light. In sarcoma these distinct lines are lacking. The same clear-cut diaphyseal line differentiates parosteal callus from a proliferating bone fragment which has been carried into the muscle. Exostoses are often bilateral or multiple and are most frequently met with where the bone lies near the surface. They have their origin near the epiphyseal line but may travel upward with the growth of the bone and thus be found on the diaphysis at some distance from this line. In these exostoses the periosteum is pushed out and bone shaft and exostosis appear as one. At operation the impression gained from the radiograph is confirmed, while a parosteal callus usually may be detached from the bone by a rocking or a prying motion. Occasionally a patient with an exostosis gives a history of trauma but the relationship is incidental, not causal, the injury having attracted the patient's attention to the presence of the bone mass. Subperiosteal exostoses of traumatic origin are also reported (Hoswell [42] Schuler [43]) and it is probable that the osseous masses which sometimes recur after the removal of a parosteal callus are in some cases exostoses or bone scars rather than recurrent parosteal callus formations. Cartilaginous exostoses are often multiple; the location both as regards the bone affected and the aspect of the bone differs from that of a parosteal callus. Cartilaginous exostoses merge with the bone outlines or rather encroach upon them.

Is there such a thing as preventive therapy in parosteal callus? Since it is not possible in any given case to determine whether there is likelihood of such callus development, — and the number of such callus formation is in-



Fig. 9. Very heavy, bony trabeculae and small marrow cavities.

finestimal compared to the number of injuries which might determine them,—it would seem wisest to apply the best treatment for the injury itself. But in reducing any dislocation, the possibility of the development of parosteal callus is an added reason for the greatest possible gentleness to be exercised.

There has been much discussion regarding the indications for operation, but after all, this phase of the subject is a simple one. The period of growth is self-limited, the presence of the callus is in itself no menace to the life or health of the patient, the need of operation is, therefore, determined by the degree of functional disturbance. When the callus is so situated that it interferes with the normal motions of the member (and this is frequently the case when it is situated in the brachialis anticus or the quadriceps extensor femoris) so as to seriously interfere with the accustomed employments, operation is indicated. Where a nerve is involved in the callus (usually the median or the musculospiral in callus formations in the plexa cubiti) or where there is interference with the blood supply, operation is of course also necessary. Periarticular ossification is a serious complication and here the prognosis is not a good one. Where the callus mass is free within the muscles, good functional results may be expected even where ossification has been extensive for at worst a fibrous creatrix gives better service than does osseous tissue.



Fig. 10. Case 6. A parosteal callus on the brachialis anticus twenty-two years after the receipt of the determining injury.

Where the callus is adherent to the shaft of the bone the outlook is hardly less bright.

The time for operation has also been much discussed, but in answering this question we may again have recourse to radiography. The agreement in size of the radiographic image with the palpable mass, the clear dark outlines of the shadow indicate that the process is at a standstill and after operation at this period there should be no ossification of the surrounding tissues. Too early operation, before the injured tissues have regained their differential function, and the denudation of the bone (resulting according to La Pointe in a circumscribed proliferative osteitis) are the causes of recurrence of the callus or the formation of an exostosis. A slight proliferation, a bone scar, usually develops after the removal of an adherent parosteal callus, but such a scar is in no sense of the word a recurrence. In early operations it is necessary to remove the neighboring diseased tissues, but if the ripening of the callus is awaited, the operation can be conservative, giving promise of the best functional results.

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likely that the similarity of symptoms to those of weak feet has caused it to be overlooked. While those cases in which there are no loose bodies will be relieved by the use of the felt pad if sufficiently long continued the contrary will be true of the other cases. The cases with loose bodies will require arthrotomy as a rule. As in my first case this may be unnecessary where the bodies are very few in number and very small.

It seems worthy of note that in my six cases only one foot has been the seat of this injury. While it is common enough to see only one foot affected in cases of metatarsal pain from static weakness, the contrary is the

rule. This would seem, therefore to be a point of some diagnostic importance.

Not a little interest attaches to the mechanism by which this injury to the foot takes place. Under normal circumstances the second metatarsal bone is slightly longer than the first. In the presence of a diminished power of toe flexion and especially of the great toe, it is apparent that forcible impact of the ball of the foot against the ground not sufficiently guarded by the flexor power of the toes will cause the distal end of the second metatarsal to bear the brunt of the blow. It seems likely to me that we have here the explanation of the mechanism of this injury.

## CONGENITAL CONTRACTURES OF THE FINGERS WITH THE REPORT OF A CASE OF THE FAMILIAL TYPE<sup>1</sup>

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**A**LTHOUGH congenital contracture of the fingers is not infrequently encountered, little attention appears to have been devoted to the condition. When mentioned at all in standard works on general and on orthopedic surgery the description of and treatment for the deformity are generally disposed of in a few words. The reason for this appears to be that individuals affected by this deformity do not usually consider it of sufficient importance to seek medical aid; nevertheless we have encountered case reports of many patients who have been seriously incapacitated by the affection.

The examination of the following example of congenital finger contracture, with the operative findings and the results of operation, have appeared to us of enough moment to justify its report and to analyze what is generally known of the condition at the present time.

Mary J., twenty years old, unmarried, came under our observation with the history of contractures of the fourth and fifth fingers of both hands existing since birth. The affection was not very moving until the age of about fourteen years was reached. Since then, however, the flexion of the

fingers of the right hand has apparently progressed. The result has been that, in the past two years, the patient's occupation (that of ladies' maid) has been seriously interfered with, for she frequently drops objects carried in the right hand. She also wishes to be relieved of the unsightliness of the deformity.

**Family history.** The mother of the patient has had a bilateral contracture of the fourth and fifth fingers since birth; it never progressed very far and has never been very annoying. The patient's maternal aunt, however, has had the same condition from birth to a much more marked extent, so that her hands have never been very useful for household work. An operation done on one hand (tenotomy?) was not successful. The maternal grandfather had contractures of the fingers similar to those of the patient. No other members of the family are affected and there is no history of other deformities among them.

The previous history of the patient throws no light on the etiology of the deformity. She has always been well and strong and free from symptoms of constitutional disease. Although the contractures of the fingers are observed by the mother soon after birth, no attention was given to them because they appeared so insignificant. About the period of adolescence, however, the patient believes that the flexion of the fourth and fifth fingers of the right hand was more marked than that of the left, and although she could previously force a full extension of all the contracted fingers it was no longer possible to fully extend those of the right hand. The contractures of the fingers of the right



Fig. 2. Case. Girl of eleven years. Trauma injury months before. Fracture of second metatarsal with one small loose body. No arthrotomy required.

bodies in the radiogram and grating upon examination. In two of these three cases I was unable to give definite relief by mechanical support alone and therefore removed the loose



Fig. 3. Case. Girl of eleven years. Trauma injury three months before. Fracture of second metatarsal with two large loose bodies. Both required removal. There is marked grating during passive motion.

bodies by means of an arthrotomy from the dorsal surface of the foot. This resulted in entire relief from discomfort and pain.

Fig. 3 is from the second of these operative cases and shows two loose bodies of considerable size, one of which was attached at one place by means of a fine pedicle. This was also a tennis injury.

It is a curious fact that in two of the six cases no injury whatever could be recalled by the patient in spite of careful questioning on my part. In one of these cases operative



Fig. 4. Case. Girl 20 years. Trauma injury one year before. Fracture of second metatarsal with two large loose bodies. Both required removal. There is marked grating during passive motion.

removal of small corpora fibra was necessary. I have no doubt of the traumatic origin of these three cases.

Two of my cases were women below middle age, but the remaining four were girls under eighteen years of age. In two of the six cases there was evidence of static incompetence of the feet. I have no reason to believe that this stood in any particular relationship to the condition which is here described.

Having observed five cases of this character in my own practice there would appear little doubt that the condition which I have described is not extremely infrequent. It is cry

joint of the little finger. The skin was firm and thin, very little adipose tissue underlying it. The ends of the V were prolonged over the lateral surfaces of the finger and the flap thus made was reflected. The very tolerant patient permitted vigorous attempts at extension of the finger but no change could be effected. Fascial prolongations entering the skin flap were looked for but not found. It was, therefore, determined to divide the firm band that was felt under the skin (see description of the case). This fascia like membrane, immediately overlying the flexor tendon sheath, was accordingly divided, but not the least relief of the contracture resulted. The tendon sheath was then exposed, it was evident that neither the sheath nor the tendon played any rôle in retaining the finger in its flexed position. The joint capsule and ligaments alone remained to account for the contracture. With narrow bladed knife the anterior ligaments were first cautiously incised under the flexor tendons some extension of the finger was at once obtained. The more lateral portions of the joint capsule and ligaments were then superficially incised by using a little force almost full extension at the proximal articulation could be obtained. This was accompanied by faintly audible and palpable cracklings (as if periarticular adhesions were being broken). A few catgut sutures approximated the subcutaneous incision. Owing to the extension of the finger the V-flap could not be sutured in place and the V was, therefore, converted into a Y shaped suture of the skin, without any resulting tension.

The operation was repeated on the fourth finger. The experiences were exactly the same as those of the operation on the little finger and therefore, need not be repeated.

Splints and dressing were applied, immobilizing the fourth and fifth fingers in full extension. The wounds healed by primary union. Two weeks after the operation it was found that the fingers although in almost complete extension, showed tendency to flexion, and the following apparatus was, therefore, devised by Oppenheimer.

A small anterior splint with a band around the affected phalangeal joints is the one generally employed for maintaining and increasing extension of the fingers. The objection to the splint is the pressure on the finger pads, which may be very painful and even lead to localized necrosis. The circular band may interfere with the circulation in the finger. The splint is not easy to adjust or to keep in place. The apparatus we employed was made on a plaster model of the hand, the fourth and fifth fingers of the model being broken and overcorrected. Layers of cloth painted with celluloid solution were applied over the plaster cast reinforcing steel wires were placed between the layers of cloth. The resulting splint

fit snugly and was light and very strong. It was cut away over the palm and the meta-carpophalangeal articulations (see diagram). The hyperextension at the latter joints nullified the extension-effect of the splint. A small felt pad was therefore placed over these articulations and was the fulcrum for a wire spring encircling the fingers at one end and included in the wrist band at the other. The splint could be put on like a glove the strap for attachment being at the wrist.

This appliance was worn continuously for about two weeks and subsequently at night for several weeks more.

The result, as ascertained at a recent examination, is a useful hand with good power and degree of flexion and extension, adduction and abduction of the fourth and fifth fingers (see photographs). The prominence of the dorsal aspect of the proximal phalangeal articulations remains almost unchanged. This could be improved by an osteotomy which we considered inadvisable, for the indication would merely be a cosmetic one.

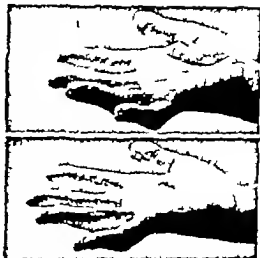
The description of the case herein presented might serve as a typical example of congenital contractures of the fingers. In some particulars, however, and especially in the experiences at operation, it differs from previously reported ones. A survey of the subject may therefore be permitted.

Concerning the etiology of congenital finger contractures very little is known and no satisfactory theory has as yet been advanced to explain the mechanism of its formation. According to some observers the cause lies in the weblike formation of the skin. That this is not the case is amply proven by examination of these finger contractures in children. Adams,<sup>1</sup> in the best paper we have found on the subject, shows that there is no appearance of congenital skin contraction, or formation of a longitudinal web in the finger when seen in early childhood. I have taken casts from young children that show transverse creases on the palmar aspect of the phalangeal articulations as well defined as they naturally should be. In addition, we wish to point to the fact that the fold of the skin, though

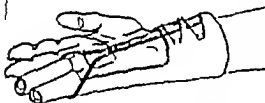
hand appeared to slowly progress and, in the past few years, to very slightly involve the middle finger.

The general physical examination revealed a healthy young woman of good physique free from other deformities. The contractures of the left hand are to a very much slighter extent, a replica of those of the right. The proximal phalanges of the fourth and fifth fingers are slightly hyperextended and the second phalanges are flexed to an angle of about 15 degrees on the proximal ones. The distal phalanges are not flexed on the middle ones. The flexion contracture cannot be overcome; the resistance apparently being in the subcutaneous tissues of the palmar aspect of the proximal phalangeal articulations. Here there is a weblike appearance of the skin. Upon palpation it could be ascertained that the resistance to extension was not in the skin, but lay apparently in a tense, fascial band that could be distinctly felt under the skin. Free motion exists in all the articulations.

The contractures of the fingers of the right hand are much more extensive than those of the left.



Palmar aspect of right hand before and after operation



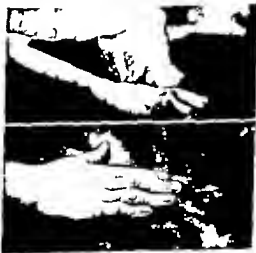
Oppenheimer splint for maintaining and increasing extension of fingers

The proximal phalanges of the fourth and fifth fingers are more markedly hyperextended and the second and third phalanges (lying in one plane) are flexed on the first to an angle of about 45 degrees. The dorsal surfaces of the proximal phalangeal articulations are very prominent. The skin over the palmar aspect of the proximal phalangeal articulations is thinned and free from creases, but makes a weblike fold in the long axis of the fingers. As in the left hand the cause of the contractures appears to be firm bands that is felt under the shined skin. Any effort to straighten the fingers makes these bands very tense. All the phalangeal as well as the met carphalangeal articulations are freely movable. The flexion power of the fingers is good; adduction and abduction, however, seem somewhat weak. Electrical tests are negative. Sensation is normal. A slight degree of contracture of the same type exists in the middle finger.

An x-ray examination of the fingers of the right hand stereoscopically made show that the bones and joints are normal. The first and second phalangeal

articulations of the fourth and fifth fingers are in flexion, the usual space separating the heads of the bones is distinctly seen, and no abnormality of the joints can be determined.

*Operation.* May 3, 1913 (Neuhof) Local anesthesia. The operation generally recommended (in the scanty descriptions found) is a Y-shaped incision of the skin, which, when converted into a Y is supposed to relieve the contracture. A Y-shaped incision was accordingly made through the weblike skin over the palmar aspect of the proximal



(a) Right hand before operation  
(b) One month after operation

The condition consists in a dropping of the second and third phalanges on the first. They can be restored to the normal position by gentle manipulations but drop again as soon as the extending force is withdrawn. No evidence of muscular or tendinous contractions, no bands, and no appearance of shortening of the skin are to be observed in this early stage. The second stage, generally reached in the seventh to the tenth years of life, consists in a confirmed contracture of the fingers. The first phalanx is hyperextended and the second and third phalanges, lying in one plane, are flexed to a varying degree on the proximal one. The skin over the palmar aspect of the first phalangeal joint is of a folded weblike appearance, the web lying in the long axis of the finger. The transverse creases of the skin are less evident than normally in this atrophic contracted fold. There is no evidence of muscular contracture but, in most cases, fascial bands are to be felt along the palmar aspect of the first and second phalanges. The affected fingers cannot be straightened out by any amount of force. The resistance appears to be partly in the contracted skin and fascia and partly in the contracted condition of the articular ligaments by adopted shortening during growth. Especial emphasis is placed upon the latter because the shortened ligaments and capsules of the proximal phalangeal joint proved to be the barrier to extension in the case upon which we operated and because several reported unsuccessful results of operation appear to have depended chiefly upon non-recognition of this ligamentous shortening.

Spontaneous arrest of congenital contracture of the fingers in the first or second stage unquestionably occurs in many instances, but an increase of the contraction occurs in a certain proportion of the cases. This progression of the flexion contracture occurring in the fifteenth to the twentieth year of life, comprises the third stage, according to Adams' classification. In a considerable proportion of cases, this stage the contraction involves the fifth and fourth fingers even the second as well. The terminal phalanges of the affected fingers usually increases so that

the hand becomes progressively less and less useful. Extension of the fingers is impossible when it is attempted, flat fascial bands, of the same type as those described in the second stage but of more pronounced extent, are to be felt and seen. Because these central longitudinal bands do not correspond to the digital prolongations of the palmar fascia, it is difficult to account for their occurrence. Adams believes that they represent an involvement of the terminal fibers of the fascia inserted into the skin. At the first operation he performed for finger contracture he found it necessary after dividing some small bands transversely to pass the knife horizontally under the skin and divide numerous bands passing upward towards the skin. The operation he performed was a subcutaneous one. In the description of the open operation we practiced attention was called to the fact that the flap of skin comprising the web was reflected without any such contracted fascial prolongations into the skin being encountered. Indeed, it was surprising that no fascial band was met and it is now our impression that the band in question is a combination of contracted skin, subcutaneous tissue, and articular ligaments and capsule.

The treatment of the first stage of congenital finger contracture should be purely mechanical. Good results are obtained if one of the varieties of extension splints is worn for a considerable period of time. After the flexion of the affected fingers is controlled the splint need be worn at night alone. It is for the second and third stages of finger contracture that operative measures are indicated. Some of the procedures devised are plastic operations on the shortened skin, subcutaneous and open division of the fascia, tenotomy, osteotomy, etc. Each of these methods has been followed by a considerable percentage of failures. Even amputation of the finger has been found indicated in order to eliminate the useless and unsightly digit. The operation advised and practiced by Adams was successful in a few cases. At two or three points in the contracted zone a narrow-bladed knife is introduced. All resisting fascial bands are divided and the scalpel is then carried horizontally to and

short, is not tense and showed no evidence of having been under tension. The free dissection of the web that was made in our operations in no way relieved the contractures. Another suggestion for the explanation of the condition is that offered by Adams. He studied some of the cases in early childhood and found that the only defect then present was a dropping of the second and third phalanges apparently from some failure of the power of extension. He therefore suggests that the cause may be a failure or imperfect development of the lumbricales or interossei, whose special office it is to add in the power of extending the second and third phalanges. That this is not the case however is shown by Adams himself in as much as he reports finger contractions, treated in early stages by extension apparatus entirely well (i. e. full extension) after the treatment. Furthermore, in the case upon which we operated good extension, adduction and abduction power promptly returned to the contracted fingers after the obstruction to extension was removed. The inefficacy of tenotomy for the relief of the condition clearly shows that it does not depend upon flexor tendon shortening.

Heredity plays an unquestioned rôle in congenital contractures of the fingers. Indeed an examination of the literature of the subject leads to the conclusion that the cases of congenital finger contractures may be divided into two groups, the familial and the isolated. We have gained the impression that the former generally presents contractures of the fourth and fifth fingers of both hands the latter often of the fifth finger and in many instances unilateral. This statement cannot be more definite because the details of many of the reported cases are so meager. The impression has also been gained that the contractures of the familial type are generally more severe. In some of the reported families many of its members were subjects of the deformities usually however not more than two or three of one family are involved. None of the histories we have seen describes the lesion in more than two generations the patient we have reported is a member of a family in which the affection runs through

three generations. In view of the pronounced hereditary tendency congenital contractures of the fingers should not be considered as accidental anomaly of development, but rather a developmental fault. It is interesting in this connection to note that the condition is not very uncommonly associated with hammer toe and other deformities.

Before proceeding with the symptoms and treatment of congenital finger contracture it may not, perhaps, be out of place to indicate that it bears no relation or similarity whatever to Dupuytren's finger contracture. Attention has been called to this nevertheless we find that both conditions are not infrequently grouped under one head. Dupuytren's contracture is an affection of the palmar fascia, an acquired disease of adult life occurring chiefly among males. Both the central and the lateral digital prolongations of the palmar fascia are involved and, as a result, the proximal phalanx is held in a flexed position. Congenital contracture of the fingers, on the other hand is observed soon after birth and is most common in females. Neither the central nor the lateral prolongations of the palmar fascia is ever involved and the proximal phalanx is generally held in the hyperextended posture. The operative findings in the two conditions vary accordingly.

That congenital contracture of the fingers may be of very slight extent and give rise to little or no inconvenience was indicated in the introduction to this paper. This is far from being an invariable rule, however. The inconvenience of the contracture is generally in direct proportion to its extent, but some cases are reported in which considerable annoyance appears to have resulted from comparatively mild grades of the deformity. In describing the clinical history of congenital finger contractures three stages were observed by Adams. No other writer appears to have studied these cases from early childhood through adult life, and we can, therefore do no better than to follow his classification and description.

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Spontaneous arrest of congenital contracture of the fingers in the first or second stage unquestionably occurs in many instances, but an increase of the contraction occurs in a certain proportion of the cases. This progression of the flexion-contracture occurring in the fifteenth to the twentieth year of life comprises the third stage according to Adams' classification. In a considerable proportion of cases reaching this stage the contraction involves not alone the fifth and fourth fingers, but the third and even the second as well. The flexion of the terminal phalanges of the affected fingers gradually increases so that

the hand becomes progressively less and less useful. Extension of the fingers is impossible when it is attempted. Flat fascial bands of the same type as those described in the second stage but of more pronounced extent, are to be felt and seen. Because these central longitudinal bands do not correspond to the digital prolongations of the palmar fascia, it is difficult to account for their occurrence. Adams believes that they represent an involvement of the terminal fibers of the fascia inserted into the skin. At the first operation he performed for finger contracture he found it necessary after dividing some small bands transversely to pass the knife horizontally under the skin and divide numerous bands passing upward towards the skin. The operation he performed was a subcutaneous one. In the description of the open operation we practiced attention was called to the fact that the flap of skin, comprising the web, was reflected without any such contracted fascial prolongations into the skin being encountered. Indeed, it was surprising that no fascial band was met and it is now our impression that the band in question is a combination of contracted skin, subcutaneous tissue and articular ligaments and capsule.

The treatment of the first stage of congenital finger contracture should be purely mechanical. Good results are obtained if one of the varieties of extension splints is worn for a considerable period of time. After the flexion of the affected fingers is controlled the splint need be worn at night alone. It is for the second and third stages of finger contracture that operative measures are indicated. Some of the procedures devised are plastic operations on the shortened skin, subcutaneous and open division of the fascia, tenotomy, osteotomy, etc. Each of these methods has been followed by a considerable percentage of failures. Even amputation of the finger has been found indicated in order to eliminate the useless and unsightly digit. The operation advised and practiced by Adams was successful in a few cases. At two or three points in the contracted zone a narrow bladed knife is introduced. All resisting fascial bands are divided and the scalpel is then carried horizontally to and

fro parallel with the skin and immediately underneath it. All "fascial prolongations into the skin" are supposed to be divided by the latter procedure. After the operation an *extension apparatus is applied and must be continuously worn for three to six months*. The apparatus is so constructed that steadily increasing extension of the fingers can be carried out. After full extension has been reached and there is no tendency to return of the contracture the apparatus need be worn at night alone this period is also of many months duration. It is unfortunate that Adams did not enter into details of the results he obtained by his plan of treatment. No definite statement is made of the final degree of extension of the fingers, of the extent of flexion adduction and abduction of the painfulness of the post-operative corrective treatment, etc. etc. Several criticisms must be directed against his method. First the operation is done blindly with the possibility of damage to tendons and nerves. Secondly very prolonged after treatment by apparatus is necessary making the hand quite useless for work for many months. Thirdly the contracture is incompletely relieved by the operation apparatus being depended upon to bring about the full degree of extension. It is evident that the apparatus may not succeed in cases presenting pronounced contracture of the articular ligaments. Fourthly when the contracture of the articular ligaments is the chief barrier to extension, as in our case the operation would prove futile

The method of treatment employed by Adams has been somewhat minutely considered (to the exclusion of other methods) because it appears to be the only one that has been carried out methodically in a number of cases. It cannot be strongly recommended, however on account of the objections above advanced.

The procedure that we have carried out appears to us to be a much more logical one, especially for advanced grades of finger contracture. It is based upon the demonstration that the contracted ligaments and capsule of the proximal phalangeal articulations are the chief barriers to the extension of the affected fingers. The details of the operation are described in the report of the case. It consists essentially in a V shaped incision of the web overlying the proximal phalangeal articulation, reflection of the flap of skin, exposure of the tendon sheath, and incision of the articular ligaments and capsule. The latter are first partly divided on the palmar aspect of the finger to determine if full extension can then be obtained. If necessary the lateral ligaments are partly divided. The periarticular adhesions must then be broken in order to obtain full extension some force may be required for this maneuver. Unless osteotomy of the first or second phalanx (or of both) is added, some prominence of the dorsal aspect of the proximal phalangeal joint will remain osteotomy however can only be indicated for those cases requiring a perfect cosmetic as well as functional result.

## MODERN WAR SURGERY

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THE injuries due to bullets, in modern warfare, are so slight and relatively harmless that one who is not familiar with such injuries must wonder at the insignificance of them. However with these minor injuries are associated more severe ones due to the bursting of shells, etc. As but few reports have recently appeared in English journals in regard to the injuries received in modern warfare, I have incorporated my observations in the following article. These observations were made principally during the last Balkan war although I also had personal experience in the first Balkan war. During the last Balkan war I and two other Americans were stationed in the fourth Military Reserve Hospital in Nisch (Servia). This city lies in the southeastern part of Servia and is at the junction of two railroads, one leading to Pierot, thirty kilometers distant where the second army corps was stationed, and where during the war many battles took place. The other road led toward Ueskub which was a distributing point for the wounded from the first and third army corps stationed in Macedonia on the Bulgarian border (Fig. 1). Here during the entire war the fighting was very severe and as it was in a wild and mountainous country transportation facilities for the wounded were very poor.

At the beginning of the war most of our wounded were received from the neighborhood of Pierot. Later most of them came from Ueskub. The wounded who arrived from Pierot had in the majority of cases been injured a few days previously. Their wounds as a rule were in a fairly clean state and healed without complication. However on

the contrary the wounds of those who came from Ueskub were usually infected and very dirty. These poor fellows had been on the journey from the battlefield to our hospital seven days or more, and during this entire time but few had had their dressings changed. Some were en route much longer than this especially those who during the journey had to endure a five days quarantine against cholera in Ueskub. Many of the latter owing to the lack of physicians had never had a dressing changed. As a consequence, it was no great rarity for us on removal of the dressings, to find the wound filled with maggots and vermin of all kinds. It is useless to say that among this class of cases the wound infection was very severe and dangerous. Many of the wounded had lost their bandages during transport, so that the wounds were exposed to the dirt which surrounded them. This loosening of the bandages was no fault of the military doctor because in ninety per cent of the cases bandages were applied by a partially trained soldier nurse who did the best he could.

The mode of treatment of the wounded on the battlefield was, *First* to stop if possible, fatal hemorrhage. *Second* to transport with as great ease as possible those who had wounds of the chest or abdomen (Fig. 2). *Third* to apply splints, made of binders board and starch roller bandages, to fractured limbs. In case binders board was not at hand a metal splint or thin strip of wood was used. Usually the parts were not shaved or if so only in a rudimentary way and most of the cases were not even cleansed with soap and water. In nearly every case tincture of iodine 5 per cent, was liberally applied to the wound in the surrounding area then dry white gauze was laid over the wound and bound in position either by means of adhesive straps or by a gauze bandage.

During the war the second army lost 1000 wounded and 500 killed. The first and third armies lost between 2500 to 3000 wounded and 1000 dead. This does not include the deaths from disease such as cholera, etc. In Nisch there were four reserve hospitals, one military and one civil hospital. I have accommodated during the war 8000 patients, 5000 of whom were treated in our hospital. These had for nearly four cavalry battalions but had been transferred out of hospital and accommodated 500 patients over average number being about 200. At the close of six weeks of activity there were left in the hospital 200 men. These were removed to the military hospitals and our hospital was closed.

It was fortunate indeed that the parts had not been cleansed with water for was to this one circumstance that most of our good results were secured.

We never saw a bandage made of plaster of Paris. Most of the bandages for fractures and large infected wounds were made of starch impregnated gauze. These held extremely well and in nearly every case were in good condition when they reached our hospital. However in some infected cases the surgeon had neglected to cut a window in them to permit the exit of pus, etc. Even these cases, although they looked very bad after we had cleansed the wounds and applied iodine or alcohol 50 per cent, recovered nicely. Yet it was evident that, even in the cases in which the possibility of infection was at all present, it was best to be very careful in regard to the bandage. In these cases a large window should always be cut in one bandage so as to permit of the exit of pus, etc. Some of the patients when they arrived at the hospital were suffering from shock, a peculiar traumatic neurasthenic state which I shall describe later.

Upon arrival in the hospital we divided the wounded into two classes, the light and the severe. The severely wounded were at once examined and their injuries dressed. In no case was an immediate operation undertaken. The lightly wounded were not, as a rule touched unless the bandage had become displaced during transportation, unless an elevation of temperature or of pulse was noticed unless the bandages became saturated with discharge or the pain became unbearable. In case none of these conditions occurred, the bandage was changed first only on the fifth day. If the wound was clean, tincture of iodine was applied and over this a fresh dressing was placed. In no case was soap and water used on a wound and in those cases in which it was necessary to shave the surrounding parts, alcohol was used to moisten the skin for the shaving. If the wound was dirty the soiled material, cloth, etc. was removed as well as possible. Splinters of bone if they were entirely free were also removed. If they were connected with periosteum they were allowed to remain. In case of infected wounds, the wound was cleansed with gauze sponges moistened with alcohol. In some cases the wound was dried and tincture of iodine then applied. In others, the iodine was

not used, and the wound was just dried while in still others, a wet alcohol compress was used over the wound. From the latter we seemed to derive the best results. In case there was a large laceration, a supporting splint was also applied.

The nursing was very deficient, as we had for nurses only soldiers whom we had trained in a week's time. However they did very well since after the first week we could ascribe no case of infection directly to them. Perhaps this may be accounted for by the care we took never under any circumstances to touch a wound with our fingers or with anything except sterile gauze or a sterile instrument. These instruments were boiled at night and at noon. During the dressing period from 8 to 1 and from 3 to 8 they were thoroughly cleansed each time after use and were then laid in 60 per cent alcohol. All our dressings were sterilized in drums during the night. These drums were placed in our dressing room the first thing in the morning.

Our routine on going to the hospital in the morning was, first, to make our rounds, during which we examined each patient, looked at the dressings, and questioned the patients through a German speaking interpreter as to pain, etc. Should we decide to change a dressing we marked a cross on it with a lead pencil. This indicated that the patient was that day to have his dressing changed. It was also the rule that, as soon as we entered the ward, all who were vomiting, or who had recently vomited or who were suffering from diarrhoea, should at once notify us. These we examined closely for signs of cholera or dysentery. If we suspected cholera the patient was immediately sent to the isolation department of the military hospital at Chela Kutz.

The sanitary arrangements in our hospital were very poor the building having been previously used as a cavalry barracks. The rooms were low the walls dirty, and the floors were of rather rough boards. The toilets were at a considerable distance from the building. The attendants were ignorant soldiers the patients also, in the majority of cases were very ignorant, and it has always been a wonder to me how we escaped an epidemic of cholera.

or of dysentery. However we were fortunate and though we did as a rule discover a case of cholera at least every third day neither cholera nor dysentery assumed epidemic proportions. The patients were very docile and easily handled though they were a little negligent in obeying orders. At first we had no local anesthetics and had not the time to use general anesthetics so that all the necessary manipulations, incisions etc. were made without the use of any anesthetic at all. It was nothing uncommon for a soldier to faint during the dressing. He was laid upon the floor given some cold water and allowed to recover. After a short interval the dressing was completed.

The average daily number of cases dressed by another American surgeon and myself in addition to our operative work, amounted to about 150. Major operations were not common. During the entire period of our stay they probably amounted to about two per cent of the cases. At first it was impossible owing to the stress of our work, to systematically take histories, note conditions, and record results but after the second week, when we began to be relieved of some of the routine by our soldier assistants, we were able to study our cases with more detail and to record our observations. During a period of one week we recorded 177 cases, which I shall later summarize. The entire number of cases treated by us in our pavilion during these seven weeks of our stay was 600. In the entire hospital during the same period 2,000 were treated. From the 177 cases of which we have exact records, only five died a mortality of 2.8 per cent. This is extremely low in comparison to the mortality of previous wars. The lowness of it can hardly be due to the fact that we received only lightly wounded cases, because we were directly on the railroad from Pierot and Uskub to Belgrade and received the unsorted wounded coming in many cases direct from the battlefield.

The experience of the other hospitals in Nisch did not differ from our own and from personal observations made on visits to them I am able to verify the fact that their wounded were not any more severely injured than our own. The only explanation

of this decreased mortality must lie in the lessened destructiveness of modern implements of warfare. This decreased destructiveness may be due to the fact that the bullets are of a very small caliber, are covered with a steel mantle, travel with great velocity and have an enormous energy with great penetrating power. For this reason the wounds of entrance and exit are small, and have no defined channel connecting them. The tissues are cut clean and even large bones are perforated without being shattered, the bullet making a clean-cut hole through them. The steel mantle prevents the bullet from flattening out when it strikes the denser tissues of the body. Owing to the distance between the fighting divisions of the two armies, bayonet and saber wounds were very infrequent. Out of 177 cases we had only two bayonet and one saber wound. This corresponds with the experience of other surgeons who have served in recent wars.

We divided our wounded into two great classes, the clean and the infected. The clean wounds were handled as little as possible. In many cases the primary dressing was allowed to remain until the day of the discharge of the patient from the hospital. Then it was changed, and, if necessary, a fresh bandage applied. If the bandage became loose or was moistened because of serous discharge the dressing was removed, the skin surrounding the wound was cleaned with benzoin, and the wound itself was touched with tincture of iodine. A dry dressing was then applied. In no case was a clean wound sounded for the purpose of locating a bullet or of defining its course. We were supremely indifferent as to the presence or absence of a bullet in the tissues and sought it only in case it gave rise to pain or inconvenience, or in case its presence was indicated by a superficial abscess or by a hard mass under the skin.

A bullet may also make its presence known by means of reflex or pressure phenomena. We had several of these cases where pain was produced by a bullet pressing upon a nerve but it was deemed best not to interfere by entering upon a probably useless search.

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tively few severely infected wounds. Out of 177 cases we had only 24 severely infected. Of these the greater part were lacerated wounds due to shrapnel. It seems that in these cases the cause of the infection very likely was the dirt, pieces of cloth etc. which had been blown into the wound at the time of the explosion.

Another large class of infected wounds was those due to comminuted compound fractures. These have as a rule a large opening communicating with the air and are due to shrapnel or to shells. The comminuted fractures which have only a small opening in the skin frequently escape infection.

The non-penetrating wounds seem very prone to infection. Of our non-penetrating wounds probably 60 per cent were infected. The reason for this is hard to explain, but it may be due to the fact that the bullet at the time of its entrance into the tissues is losing its velocity and therefore has a greater explosive power than a bullet going at a greater velocity, so that more of the clothing is carried into the wound and the tissue injuries along the path of the bullet are greater. For this reason any bacteria which may have been carried in with the bullet find a place of lessened resistance where their growth is not greatly hindered. Their virulence however seems to be reduced as abscesses resulting from the activity of these bacilli are very mild and seldom do great damage. Large hematomata unless opened and drained, as a rule became infected so that they finally developed into large abscess cavities. It eventually became our routine as a prophylactic measure to open and drain all these hematomata. In no case did we introduce a drain. In two of our severe wounds gas bacillus infection occurred. In one of these it was possible to save the patient by a shoulder amputation. In the other an immediate amputation of the leg was done but the patient died. In one of our cases the bullet, in penetrating the leg had evidently destroyed the anterior tibial artery. Gangrene had already developed on the entrance of the patient into the hospital, and while waiting for the line of demarcation to develop tetanus set in. In spite of immediate operation the

patient died. In this case we did not use prophylactic injections of tetanus antitoxin, since we did not have it at that time.

Owing to the expense we very seldom made a prophylactic injection of tetanus antitoxin. Bier's method of hyperæmia was not used because we did not possess the proper means. However the alcohol moist dressings which we used acted in a somewhat similar way for they produced an active instead of a passive hyperæmia. The result of this treatment was very satisfactory. In every case in which an abscess was present it was locked, all the pockets opened and gauze or rubber tube drainage introduced after the abscess cavity had been thoroughly washed out with alcohol (60 per cent). The results of this treatment were extraordinary. In a few days the infected wound showed only a clean granulating surface.

In considering the injuries produced in modern warfare one is surprised at the great preponderance of the wound of the extremities to those of the chest or abdomen. In our series of 184 injuries, 134 or 72.8 per cent, were of the extremities. Of the injuries to the trunk 17 or 9.2 per cent, were of the chest and 6 or 3.2 per cent, were of the abdomen. Among 184 injuries there were 15 or 8.1 per cent, head injuries. Of these, 5 or 2.7 per cent, were of the scalp 2 or 1.08 per cent, were skull injuries and 8 or 4.3 per cent, were face injuries.

*Head injuries.* While head injuries produce the greatest number of deaths on the battlefield in the reserve and base hospitals the percentage of deaths from injuries of the head is very small. In those cases in which a bullet has been fired from a short distance, death, as a result of the extensive destruction caused by the bullet, occurs immediately. On the other hand if the bullet has been fired from a distance it may entirely perforate the head and produce little if any inconvenience. In some cases there is a momentary loss of consciousness, due possibly to slight concussion. In other cases the loss of consciousness following the entrance of the bullet continues for some time and is the result of hemorrhage. These cases frequently die especially if the middle meningeal artery is

severed but if only a small vessel is injured they gradually recover with more or less permanent functional brain disturbance. The diagonal bullet wounds of the skull are more dangerous than are the transverse or the anteroposterior. The latter are not so frequent, because in them the bullet frequently glances from the skull and produces nothing more serious than a scalp wound. Out of five scalp wounds, two were in the temporal region. In one of these the bullet was removed from the debris at the point of impact, while in the other the skull had only been touched. In both of these cases, signs of temporary increase in the brain pressure were present. Associated with this there was a temporary paralysis, in the first case of the arm and in the second, of the right side of the abdomen. The chief symptoms which one meets in injuries of the skull are *First* a primary loss of consciousness, *second* great secondary weakness, with incoordination and a lessening of the intellect, *third* sometimes a state of mental instability and the patients cry and rave, *fourth* head pain and dizziness, *fifth* vomiting may occur, *sixth* the pulse rate is decreased, *seventh* signs of localized paralysis may also be present. Jacksonian epilepsy may occur, *eighth* temporary blindness is frequent, *ninth* in addition to the above symptoms may also occur nose-bleed, ear bleed, facial paralysis, or ecchymosis in the conjunctiva. One or more of these symptoms may fail, but as a rule a sufficient number will be present to confirm the diagnosis of brain injury. The above symptoms are only confirmative of a probable diagnosis which is made from a study of the direction of the wound or exit in relation to that of the wound of entrance. Of the entire 600 cases which we treated in our wards there were only four complete perforating wounds of the skull. In one of these, in which the bullet had passed diagonally from the front to the back part of the skull through the temporal region, there was evidently a disturbance of the optic commissure since the patient was not able to see although the eyes reacted normally. In one other case the bullet passed directly through the upper part of the temporal region. There were no marked symptoms

In every case of a bullet wound of the skull in which the patient feels well for a day or two and then complains of pain in the head has a weak pulse, dizziness, in some cases stupor and, at times a severe breaking out of sweat (cold) one must consider a brain abscess. If an abscess is present it is necessary to define its location. Good localizing symptoms are, first, cramps and then, a paralysis of the muscles of one or both sides of the body. In cases of brain abscess it is necessary to operate at once as the condition is very dangerous and death may very quickly occur. If the skull has been hit in a diagonal direction a depressed fracture is rather common. In either case both tables of the skull may be involved but in many only the external table is injured. In some of these injuries where the wound is extensive a brain hernia may be present (Fig 3). This, however is more of a prolapse than a hernia, since as a rule the dura remains intact. In some instances there may be an extensive destruction of the tables of the skull without any apparent external injury except the wounds of entrance and of exit. In such patients in whom as a rule the head has not been shaved we are surprised to find on shaving the scalp that the injury is many times more extensive than we supposed. In some the bone is entirely destroyed, while in others there is but a simple fracture. In one of our cases there was a fracture of the skull in the temporal region. This patient had completely forgotten the names of various objects, so that while he knew these objects he was not able to give them their proper names. However if an object were held up in front of him and he was told its name he would indicate that that was the proper name but of his own initiative he was unable to tell the names of the different objects.

In another case of a wound in the temporal region there was a paralysis of the right arm and hand. This paralysis gradually improved, so that in two weeks the patient had entirely recovered. In instances of brain injuries in which the bullet has penetrated the skull, the question arises, When and under what circumstances should we undertake operative interference? In the second Balkan War we

did not follow the dictum of Watson Cheyne who from his experience in the Boer War declared that all skull injuries should be immediately operated. However his own results do not speak favorably for operative interference, for in three cases of perforating wounds of the skull on whom he did not operate only one died while from nine operated cases four were improved and five died. This gives a mortality of 55.5 per cent, or an increase of 22 per cent over those which had not been operated.

*Wounds of the face* Face wounds are relatively few. In one of our cases the bullet passed through the cheek on one side and out through the cheek on the other (Fig. 4) passing through and fracturing the lower jaw on both sides and perforating the base of the tongue. At the time of the patient's entrance to the hospital the tongue was so swollen that it was impossible for him to close his mouth and nourishment could only be taken in liquid form and then only in the smallest quantities. In five or six days the swelling had subsided to such a degree that a coaptating splint could be applied. In another case the bullet had entered the cheek below the malar bone and had lodged in the skin beneath the lobe of the ear (Fig. 5). The bullet was extracted and the wound quickly healed except that at the point of entrance a fistula persisted for a long time and from it was discharged a thin fluid evidently the secretion of the parotid gland. This discharge was very irritating and quickly produced a marked and extensive eczema of the same side of the face. The eczema was treated by zinc ointment, and improved as the fistulous opening gradually closed. The reason for the closure evidently was that drainage of the fluid took place into the mouth from a secondary opening almost directly opposite the wound of entrance.

Closely related to the wounds of the head are those of the neck. In only one of these had we cause to worry. This was a case in which the bullet had penetrated the neck a little to the left of the larynx and had come out further back on the right side. This patient, for several days, was unable to swallow and had to be fed by means of the stomach tube (Fig. 6). Recovery was complete.

*Wounds of the thorax* Direct thorax injuries we found very frequent. Of 184 cases there were 17 thorax wounds of these, 8 were penetrating. In four of the penetrating wounds haemothorax occurred in one as long as fifteen days after the injury. In this latter case the patient had apparently completely recovered and was going around the hospital when he became short of breath, began to cough and had a pain in the affected side. The shortness of breath and coughing increased and when I examined him two hours later I found the chest full of fluid. The dullness extended as high as the nipple line on the left side. The patient was kept quiet, given morphine and gradually recovered. Owing to lack of ice we were not able to make any local application of it. In 3 of the 8 penetrating wounds of the chest, empyema developed. It was peculiar however that empyema took place only in those cases in which the chest had not been entirely perforated and the entrance wound had not entirely closed. In these cases, when the wound remained open the respiratory movements pumped the air in and out of the pleural cavity so that secondary infection was more apt to occur. In such cases also bleeding when present was apt to continue because of the absence of the slight pressure which is present to a greater or less degree at all times in the pleural cavity. We found that, after plugging up the entrance wound so as to make it air tight, the hemorrhage quickly ceased. In these cases operation is absolutely contra-indicated, with the exception of those in which the intercostal or the internal mammary artery has been severed. Injuries of these vessels may be presupposed from the location of the wound and the probable direction of the bullet. Under no circumstances should the wound be sutured. If ice can be obtained it should be applied to the chest. Cases of haemothorax should be left in absolute quiet. However it was not possible to control some of our patients. Instead of remaining quiet they were rather active and moved about, and though their breathing was difficult they did not seem to suffer greatly from their haemothorax. They all, with the exception of those who developed empyema, recovered without

accident. This is contrary to the experience of Senn, who asserts that there is very high mortality in hæmothorax when the patient is not kept sufficiently still. In bullet wounds of the lungs (Fig. 7) we have observed the following symptoms. *First* dyspnoea which may be very marked and is especially noticed in those in whom bleeding into the pleural cavity has occurred. *Second* blood in the sputum. This occurs in most cases. In a few the quantity of blood is very great, however it has no prognostic importance. *Third* hæmothorax, which is rather common. In some, it may be present without producing any marked symptoms. In a few infection occurs and empyema develops. In these fever, rapid pulse, etc. make their appearance. *Fourth* pneumothorax. This is frequently associated with hæmorrhage into the pleural cavity. If in cases of pneumothorax the wounds of entrance and of exit be hermetically sealed, it is found that the air is gradually absorbed, so that it finally disappears. In case of hæmorrhage which is difficult to control, it seems judging from clinical observations that the production of pneumothorax would be beneficial because by this means the lung tissues are compressed and the bleeding vessel decreased in size. *Fifth* emphysema. Subcutaneous emphysema is frequently associated with pneumothorax. It developed in two of our cases. Air tight packing of the wound in the chest wall stopped the progress of the emphysema, but the air was absorbed only after a long period. *Sixth* pneumonia. This sometimes develops in bullet wounds of the chest. It is generally localized to the area around the bullet and may terminate in an abscess. The symptoms of lobular localized pneumonia, as a rule, make their appearance three to ten days after receipt of the injury. *Seventh* hydrothorax. This also occurs but as a rule presents no difficulties to the surgeon and the fluid is quickly absorbed.

Out of 600 cases we had only one in which we were able to define a probable penetration of the heart. It seems that cases of cardiac perforation are very seldom found in hospitals for the simple reason that most of the injuries of the heart result fatally on the battlefield.

Cheyne, however, speaks of a case in which, from the position of the bullet tract, a wound of the heart must have occurred.

*Wounds of the abdomen.* These are so very harmless that in the present wars a laparotomy is seldom performed, for it seems to be less dangerous to allow the patient with a penetrating wound of the abdomen to remain in quiet than to institute operative interference. In two of our cases a bullet penetrated the abdomen below the umbilicus while in a third case it penetrated above the umbilicus. In the first two cases the symptoms were very slight, while in the third disturbing symptoms, such as vomiting, pains, and increased aëritiveness over the lower abdomen, were present for a few days and then quickly disappeared. On the fifth day the patient, contrary to our orders, ate heartily and in ten days left the hospital entirely recovered. In one of our patients the bullet entered the abdomen to the right below the umbilicus and had evidently lodged in the spinal vertebrae, paralysis of both extremities quickly developed, retention of urine was present, and shooting pains in the scrotum were complained of. This patient was operated on and perforation of the small intestine was found. Death occurred in a few days from septic peritonitis. At autopsy the bullet was found lodged in the body of the second lumbar vertebra. Swelling of the vertebral body in the direction of the spinal canal had occurred, so that pressure on the spinal cord was present. This accounted for the bladder and the other symptoms.

It has been held by Senn that bullet wounds below the umbilicus are more dangerous than above. In this regard Senn performed the following interesting experiment. He placed the body of an adult against a wall and then shot at it from a distance of thirty feet. The shots were sixteen in number. Of these sixteen four penetrated the abdomen without injuring the viscera. All of these four shots passed through the abdomen above the umbilicus. All of the bullets which passed through below the umbilicus perforated the viscera; the same was true of the lateral shots. The reason for the non-perforation of the bowel in bullet wounds above the umbilicus

did not follow the dictum of Watson Cheyne who from his experience in the Boer War declared that all skull injuries should be immediately operated. However his own results do not speak favorably for operative interference for in three cases of perforating wounds of the skull on whom he did not operate only one died, while from nine operated cases four were improved and five died. This gives a mortality of 55.5 per cent or an increase of 22 per cent over those which had not been operated.

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seems to be that in the standing position the intestines have a tendency to gravitate into the pelvis, so that a shot passing through the abdomen above the umbilicus would not meet any of them. However in war time the lessened mortality of abdominal wounds can hardly be attributed entirely to this factor for in many cases it has been proved that the intestines have been perforated and that there were few if any disagreeable symptoms. The favorable outcome seems to be due to the very small wounds made by the small caliber bullet. These wounds are so minute that the mucosa in most cases immediately blocks the opening and prevents the seeping out of the bowel contents. Another factor of importance is that at the time of injury the intestines as a rule are empty so that on perforation there is little tendency for extravasation. It has also been found that the high speed small caliber bullet may in some instances press the intestines aside without perforating them. However these factors are only active if the bullet has been fired from a considerable distance. Should it be fired from near at hand the explosive force of the bullet is so great that the entrance wound is large and ragged, and considerable destruction is done to the intestines and other viscera. Soldiers suffering with wounds of the abdomen should be very carefully transported. It has even been recommended that they be strapped to a stretcher and be so carried to the nearest large hospital. If stretchers are scarce a starch bandage completely encircling the abdomen extending from the axilla to the thighs may be used. Windows should be cut in this bandage directly opposite the wounds of entrance. Symptoms associated with abdominal injuries are—

**I Shock.** This as a rule quickly follows the receipt of the injury and is most marked in those who are weakened from hunger, thirst, and fatigue from long marches, especially if the fatigue is associated with the depression which follows defeat. Shock is manifested by *First* great debility. As a rule the patient falls immediately after receipt of the first shot and remains lying until help comes and he is carried away. *Second* entire loss of vasomotor control. This is indicated

through the pallor, the cold sweat, the rapid, irregular pulse and the loss of consciousness. *Third* vomiting. *Fourth* incontinence of urine and feces.

**II Hemorrhage.** This is fairly common, but as a rule is not especially dangerous to life. For a detailed discussion of this symptom see "Indications for Operation."

**III. Extravasation of the contents of the bowel.** This seldom occurs unless the injury has been produced by shrapnel or by shells.

**IV Abdominal distention** is present as a rule when the intestines have been perforated, but may be absent even when perforation has occurred, the only indication of the perforation being a marked rigidity.

**V Pain.** Severe pain in the abdomen may be present and if the viscera have been injured is almost invariable.

**VI Absence of peristalsis** is a good indicator of injury to the abdominal viscera.

**VII. Elevation of temperature.** This is not marked. We had several cases with one or more of the above symptoms who recovered without operation. However in some instances operation was necessary. On entrance into the hospital the question came up as to whether it were advisable to operate. It was our policy in every case to delay operation as long as possible. The danger of an abdominal operation during war time is well expressed by McCormic, who in speaking of his experience during the Boer War says that a man when shot through the abdomen died only when he was operated and remained alive when he was let alone.

**Indications for operation.** *First progressive bleeding.* Should signs of abdominal bleeding occur and continue and become more marked it is well to open the abdomen. However one should not be too precipitate in operating, as sometimes the bleeding ceases after a certain interval just as it does in extra uterine pregnancy. The best indicator of progressive bleeding is, of course, a progressive decrease in the hemoglobin content of the blood. This may be determined by means of the Tallquist test papers. The pulse is also a good indicator. One should not depend upon the color of the patient as a means of determining the extent of the hemorrhage because it fre-

quently happens that there is an associated shock, which of itself produces marked pallor. Hemorrhages in the walls of the bowel are frequently observed especially when the bullet has only scraped the surface (von Oettingen I, 167). Large vessels may also be perforated as a rule unless the vessel is of good size, the perforation is quickly blocked by a thrombus however if the opening is very large or if a laceration of the wall has occurred, severe and fatal hemorrhage may result. The second indication for immediate operation is the extravasation of the bowel contents. This is rather difficult to determine unless the wound in the abdominal wall is extensive and allows direct inspection of the abdominal cavity. However should the wound be small the absence of liver dullness and its replacement by an area of resonance as a rule indicates perforation of one of the hollow viscera. The above indications for immediate operation are similar to those given by Senn, Bornhaupt, Seydel, Hilderbrandt, von Oettingen and others. In severe abdominal injuries in which a large part of the abdominal wall has been shot away or in which a small opening in the abdominal wall is accompanied by a strangulated hernia, immediate operation is imperative.

**Prognosis** In general the prognosis of abdominal wounds is modified by the character of the wounds, the relationship of the wounded to the transportation service, the method of transportation, and the kind of treatment. In the Franco-Prussian War (1870-1871) the mortality from abdominal injuries was 70 per cent. In the Russian-Japanese War the mortality was 50 per cent. In the Balkan wars it was much lower (exact statistics are not at hand). It seems that the immediate mortality from abdominal injuries is third, preceded only by that due to heart and head injuries. In the Boer War Watson Cheyne observed immediately after the battle of Karey Siding twenty five cases of perforating wounds of the abdomen. Of these, sixteen died, one was operated on but died, the other eight recovered, giving a mortality of 50 per cent.

The favorable abdominal wounds usually run a very quiet course without disturbing

symptoms. The majority have only a slight rise of temperature (up to 39° C.) slight abdominal pain swelling of the abdomen and absent peristalsis. As a rule they entirely recover in five or ten days in some an abscess may form. In four such cases observed by von Oettingen, the abscess opened in very unexpected places and in a few instances was the cause of a delayed peritonitis. Von Oettingen also observed a case in which the intestinal wall became gangrenous from extension of the abscess. Hematoma of the abdominal wall may also occur these as a rule are found only in the small pelvis. It is better to let them entirely alone unless they give rise to abscess.

**Bladder injuries** Perforation of the bladder as a rule is not serious. It gives rise to only a transient hemorrhage, blood being present in the urine for a few days only. As a rule no extravasation of urine occurs. Undoubtedly perforation of the liver, the spleen, or the kidney must have occurred in many cases although symptoms of such injury were never observed.

**Extremities** Wounds of the extremities were very frequent, much more so than were those of any other part and most peculiar was the fact that the lower extremities were injured more frequently than were the upper. From 184 cases we had 75 wounds of the lower extremities and only 59 of the upper. The reason for this I am unable to determine. Of the 50 cases of wounds of the upper extremity 16 or 8.7 per cent, were of the arm and shoulder, 21 or 11.4 per cent, were of the lower arm, and 22 or 11.0 per cent were of the hand. Of 75 wounds of the lower extremities (or 40.07 per cent of our total injuries) 27 or 14.05 per cent, were of the thigh, 24 or 13.04 per cent, were of the leg and 24 or 13.04 per cent were of the foot. Among these injuries, fractures occurred fourteen times, divided as follows: humerus, 1; clavicle, 1; radius, 6; radius-ulna, 1; femur, 1; tibia, 4. All of our fractures ran a favorable course and all were healed. In the infected cases the healing was slower but in all the functional results were good though deformity was marked. Many of the fractures had not been diagnosed in the field hos-

plint, and in some instances, even when diagnosed came to us without fixation dressings. It was also difficult to control our patients and to restrain them from changing their dressings or leaving their beds whenever they felt any desire to do so. Our treatment was the usual one of reduction, extension and retention by means of fixation dressing and plints. Instead of plaster of Paris we used starch bandages. These if thick enough—that is, if they were put on in seven or eight layers,—had practically the strength of a plaster cast. Between the layers of the starch bandage strips of bladder board were inserted or else thin strips of wood were incorporated into the dressings. With such bandages it is possible for the patient, even with a fracture of the tibia or of the femur to go about with out danger of increasing his injury. In case the fracture has been infected it is an easy matter to cut a window so that a daily change of dressing may be made. Fractures produced by the transverse penetration of a bullet through the bone are very rare and are generally due to shrapnel. As a rule the small caliber bullet passes directly through the bone without injuring it to any great extent. It produces only a clear cut hole while the shrapnel produces as a rule extensive destruction. The above does not agree entirely with the experience of Küttner who doubted that it was possible for a bullet to pass through a bone without causing a fracture (Fig. 8). Of the possibility of this we have convinced ourselves beyond the shadow of a doubt. However if a bullet passes through the bone in a diagonal direction there is a tendency for it to cause a comminution of the bone. In a few cases of fracture we saw an extensive laceration of the soft tissues but in many instances the only external indication of the fracture was a slight discoloration of the skin over the site of the break, the skin itself remaining uninjured. Swelling of the surrounding tissues sometimes takes place and a large hematoma may develop. This was marked in those fractures of the lower extremities which had not been placed in a supporting splint during transportation to our hospital.

Bullet wounds to the tibia give rise to more fragments than do similar injuries of the

femur or humerus. The cause of this probably is that the tibia is harder than the femur or humerus, and consequently is more easily shattered (Fig. 9). It was our custom in clean cases not to remove a fragment of bone unless it was entirely free and was not connected with the periosteum. In infected wounds the bone fragments were always removed. This custom was based upon the experience of Senn, who found that if the fragments were not entirely separated they should be allowed to remain, as in some cases new bone originated from them, and greatly shortened the period of healing. Wounds of the hand were fairly frequent. As a rule, in a shrapnel wound of the hand the small bones were fractured. In a bullet wound they were frequently uninjured (Fig. 10).

**Joint injuries.** In the Franco-Prussian War (1870-1871) the wounds of the joints amounted to 4.1 per cent of all the injuries. In the Spanish-American War 2.5 per cent. In the Russo-Japanese War 7 per cent. Injuries of the joints were seldom encountered, although from the points of entrance and of exit of the bullet it was possible to conclude that in many instances the joint had been traversed. In no instance did we have great difficulty, although in one case considerable effusion developed in the joint. It was never necessary to open a joint. This agrees entirely with the experience of Küttner who reported that never in any case was it necessary for him to open a joint. In a few of our patients, although the fluid in the joint was not excessive the pain was severe. Our treatment of joint injuries was very simple. It consisted only in immobilization and in the application of moist aluminum silicate gauze dressings. Our experience in regard to operative interference is contrary to that of Bornhaupt who found it necessary in 37 out of 137 joint injuries to operate. In 14 cases he found it necessary to amputate. In one case it was the only salvation for the patient as the joint had been infected with streptococci.

**Nerve injuries.** Nerve injuries are not so common. They are indicated either by paralysis or by radiating pain. They are characterized (Küttner) in that the dis-

turbance (i. e. the paralysis and hyperalgesia) quickly disappears, so that in two or three days after the receipt of the injury the pain begins to diminish and in eight to ten days the paralysis commences to improve so that in a few weeks the patient is entirely well. In a few cases the paralysis remains and symptoms of nerve degeneration arise. In some instances the nerve does not seem to have been directly injured by the bullet but rather to be affected as the result of concussion from the passage of the bullet through the tissues adjacent to it. These are the cases in which the disturbances are transitory and in which recovery occurs in a few days. That such a concussion effect can occur may be presupposed from the experience of Dent who found severe hemorrhage in the tissues at a considerable distance from the bullet channel. This hemorrhage was not in any way connected with the channel of the bullet, and the intervening tissue was absolutely undisturbed so in the same way it is possible to suppose that the concussion produced by the rapidly passing bullet may influence a nerve so that a transitory molecular change occurs in its substance and results in a reduction of its power of conducting impulses. We had one case of neuritis as the result of a secondary infection. In a few instances we had pain (radiating) occurring at a considerable interval after injury as the result of the involvement of a nerve in a callus or in scar tissue. We saw no injuries of the sympathetic such as were described by Frupp. In one of his cases the bullet entered the right angle of the mouth and passed out through the spinous process of the third cervical vertebra. In this case the bulb of the eye sank in and the opening of the lids, likewise the pupil were markedly decreased in size. In regard to the general treatment of nerve injuries it may be said that they should be handled as conservatively as possible and operation should not be undertaken if the lesion shows any signs whatever of improvement. If a nerve has been severed the two extremities should be sutured. In case the nerve has been involved in a callus or in scar tissue it should be freed and surrounded by fascia to prevent a recurrence of the former trouble. Kuttner how

ever found that in these cases operation availed but little since the nerve as a rule was damaged by the same cause which gave rise to the scar or the callus.

*Blood vessel injuries.* In modern warfare blood vessel injuries are fairly frequent. Brentano found in the Russian Japanese War that 4 per cent of all his wounds consisted of blood vessel injuries and that 7 per cent of all his operations were done on blood vessels. This great frequency of blood vessel injuries which lead to aneurism seems to be the result of the partial cutting through of a vessel by the small rapidly passing bullet. In some cases disturbance does not occur for many days. Then attention is attracted to the parts by a small pulsating swelling or else because of pain. On examination a small aneurism is found. Among our patients it was not possible to define any of these aneurisms since we did not follow the cases for a long enough period after their discharge from our hospital. As a rule most of the patients were only in the hospital on an average for a week. Acute hemorrhage because of perforation of a vessel, occurred in several instances. In one owing to sloughing in the tonsillar region a branch of the pharyngeal artery ruptured with severe bleeding. To control it, it was necessary to ligate the carotid. In another the brachial artery was severed and moist gangrene of the arm and hand resulted. The gangrene extended so high that a shoulder joint amputation was necessary. In another the femoral arteries were perforated the femoral vein was thrombosed so that a high amputation of the thigh was required. In still another case the posterior tibial artery was destroyed and at the same time the bone was so badly shattered that it was necessary to amputate at the knee. In all of the above cases hemorrhage was profuse and continuous and with the exception of the perforated femoral artery developed several days after the entrance of the patient into the hospital. In the last of the above cases the bleeding was due to perforation of the artery by a sharp fragment of bone — the result of the disobedience of the patient, who contrary to our orders, persisted in going about and in standing on his leg. Hemorrhage from wounds of large veins

we never encountered. According to Kuttner with the exception of frequent cases on the battlefield, they never cause death. Kuttner saw one such case in which the opening into the vein was plugged by a piece of the neighboring tissue. This acted as a temporary haemostat and gave rise to a thrombus at this point.

**Shock.** There are two classes of shock encountered in war surgery. One is the acute



Fig.

brief temporary shock which comes on suddenly after the injury and quickly passes away. With this I have had no experience, as it occurs upon the battlefield. However with the second variety (the chronic) which is long-lasting and somewhat dangerous to the patient, I have had considerable experience, for among our patients we had many who suffered from this most peculiar shock complex. They were very weak, had lost all

their energy and were content to lie quiet and motionless. As a rule they had a very rapid pulse, 110 to 115 which was weak and thready at the same time the respiration was increased. There was a tendency to moisture of the hand. Pain in the breast, chest, and abdomen was present in many cases. Likewise in a few cases, pain was complained of in the head, especially in the forehead and temporal region. Finger tremor (very rapid) was present. The pupils were generally active and even. The respiration usually was painful and was of a somewhat asthmatic type. Blood was occasionally present in the sputum, but as a rule lasted only one or two days. Vomiting generally was absent. On examination of the heart one was impressed with the hollow character of the sounds, especially of the second aortic. Dizziness was frequently a marked symptom. The heart on percussion appeared to be increased in size. This increase in size, together with the weak tone and the weakened apex impulse, led naturally to the diagnosis of a dilatation. These patients went around like old men and were incapable of the least exertion. In the majority of cases, we saw them first on the third to the fifth day after the onset and did not see the patients in the first stages of their trouble but only in the second. Since the patient's memory was as a rule not good, and as he generally was stupid, it was difficult to obtain an accurate history; however it appears that in most instances the shock was the result of the explosion of a bomb in the immediate neighborhood of the patient, generally at a distance of two to three meters. As a result of the explosion, the near by soldiers were thrown a distance of three to four meters. They were immediately rendered unconscious and recovered consciousness only after a period of one to two hours. In some the unconscious period lasted longer. During their period of unconsciousness they frequently omitted but afterwards could remember nothing of it. Patients with this symptom complex as a rule finally entirely recovered but it was weeks, sometimes months, before they were in condition to resume their usual occupations. The pathological changes pro-

ducing this shock syndrome which resembles traumatic neurasthenia are difficult to define since autopsies on patients suffering from this disturbance have not been made. In one case, however, a laparotomy was performed because symptoms of hemorrhage into the peritoneal cavity were present. On opening the abdomen no free blood was found but small hemorrhages underneath the serosa were seen over the entire small intestine. These small hemorrhages seemed to be the result of severe traumatism to the abdominal wall from the explosive force of the bomb.

deafness and slight concussion (cerebellar) the result of the passing in the near neighborhood of a large granite shell. Hildebrandt in the Japanese War saw hemorrhages into the conjunctiva of both eyes due to the same cause. In considering the cause of shock we must not forget that the negative pressure succeeding the primary compression due to the explosion may in some way be instrumental in producing pathological changes giving rise to this condition. The sudden release of pressure from the surface of the body may give rise to hemorrhages into the serous membranes.

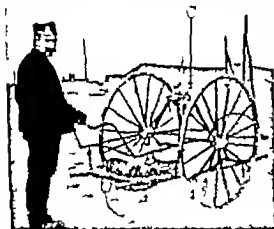


Fig. 3 One method of transportation. A very rough one.



Fig. 3



Fig. 4

Fig. 3. Wound of skull with hernia of the brain.  
Fig. 4. A box patient the bullet entered the left cheek, passed through the tongue knocking out a molar on each side and then came out through the opposite cheek. The tongue is so swollen that it was impossible to close the mouth. Condition rapidly improved. In two weeks he was discharged.

The hemorrhages and the condition of shock may be the result of both of these forces. Up to the present time no experimental work has been done in this field.

**Burns.** It sometimes happens that burns of the face or other parts may occur due to the explosion of shells in close proximity (Fig. 11).

**Erysipelas.** Only once did we have erysipelas as a complication. This patient was immediately removed to the isolation department of the military hospital at Chela Kula.

**Cholera and dysentery.** As in all large wars in which considerable bodies of men take part,

To which phase of the force—that is, the compression phase or the vacuum phase—the shock is to be attributed is difficult to define. It may be due to the primary positive pressure (compression) which is exerted suddenly against the surface of the body at the time of the explosion. This may cause a strain and possibly a slight dilatation of the heart from which it slowly recovers. The hemorrhages in these cases were only indicators of a sudden elevation of blood pressure in the vessels, the result, as one might say, of a severe compression of the body by the surrounding compressed air. Hemorrhages into the brain cortex that is into the meninges may occur as easily as into the serosa of the bowel. These hemorrhages, if present, would account for the peculiar symptoms of the shock. Kuttner describes a case of



Fig. 3



Fig. 4

Fig. 3. Bullet wound causing injury of the parietal with skull and orbital and subsequent erosion. The exsanguination proved extremely difficult to treat. It finally extended over the entire right face and neck and was cured only after the orbital was treated.

Fig. 4. Wound of the face causing loss of left eye.

especially in the Orient. It is difficult to entirely exclude cholera and dysentery. We were no exception to the rule for in our hospital it was usual for us to discover a case of cholera every third day and dysentery was very frequent. Both classes of patients were immediately removed to the isolation department and we were extremely fortunate to have no epidemic.

#### RÉSUMÉ

The experiences obtained by a surgeon in modern warfare are unique for under no other circumstances would he meet so peculiar a variety of cases nor would he see severe and what to him should be fatal injuries recover without serious inconvenience. He is compelled to modify his views in many particulars in regard to his treatment of shot wounds for he will see many cases which he formerly would have operated upon recover without operation while others with operation die. However he should not apply his war experience to civil practice for both are radically different and what is proper in one is not called for in the other.

I would like further to draw attention to certain facts. First that injuries received in modern warfare should be handled as little as



Fig. 5. Bullet wound of the chest. Lungs perforated. No symptoms referable to the chest are present.

is possible. Second that dry dressings should be used except in very severely infected wounds for the latter layers of gauze moistened with 60 per cent alcohol are the best. I would also like to draw attention to the fact that the most important factors having influence upon the ultimate course of a wound are the primary dressing and the transportation. Should the former be soaked and the latter bad the later course of the wound is unfavorable. Under no circumstances should wound be touched with the hands. It seems from our experience that instruments which have been thoroughly cleaned with alcohol are entirely suitable for the handling of such wounds. In regard to statistics, I shall quote a few though a rule statistics of themselves, unless taken from a material are unreliable. First in regard to the proportion of infected to clean wounds. Out of 66 wounds 33 were infected and 33 clean from these there were 137 wounds in which the bullet had entirely perforated and 29 in which the bullet did not pass entirely through the part. Of the perforated wounds, 12 were



Fig 8

Fig 9

Fig

Fig 8 Large lacerated shrapnel wound of upper arm.  
Fig 9 Shrapnel wound of exposure and shattering of the tibia and fibula.

Fig Shrapnel wound of the hand. Fracture of second and third metacarpal bones and second phalanx of little finger.

lacerated and 125 were not. Of the non-perforating wounds 21 were lacerated and 8 were not. Of 154 wounds 56 were due to shrapnel, 94 to bullets, 2 to bombs, and 2 to bayonets. Of 184 wounds 5 or 2.7 per cent were of the head, 8 or 4.3 per cent, were of the face, 2 or 1.08 per cent were of the skull, 5 or 2.7 per cent, were of the neck, 17 or 9.2 per cent, were of the chest, 6 or 3.2 per cent, were of the abdomen, 59 or 32.6 per cent were of the upper extremities and 75 or 40.18 per cent, of the lower extremities.

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It claimed that 1 per cent of all the wounds were due to shrapnel wounds or bayonets.



Fig Burn of face from too close proximity to an exploding shell.

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## CONTRACTURED PSOAS PARVUS TENDONS

### THEIR SIGNIFICANCE AND CLINICAL RELATIONSHIP TO LESIONS OF THE RIGHT ILIAC REGION

B. T. L. MACDONALD, M. D. WASHINGTON, D. C.

THERE is a dearth of literature dealing with contracture of the *psos parvus* tendon and its symptomatic resemblance to appendicitis, and yet the ease with which it may be mistaken for chronic or subacute inflammation of the vermiform appendix, the facility with which it may apparently perpetuate post-operative distress in the right iliac region, and our unsuspecting attitude regarding its existence seem to call for the publication of cases and comment. Doubtless the routine examination for the lesion when operating in this region would result in the recognition that it is not an extremely rare affection. The fact that the small *psos* consists mainly of tendon, that it lies upon the anterior surface of the large *psos*, and that this tendinous portion is bisected by a line drawn from one anterior superior iliac spine to the other suggests the ease with which one sweep of the forefinger will reveal its presence or absence (Fig. 1). The investigation is simplified because the great *psos* has no tendon till it passes beneath Poupart's ligament. It is worthy of remark that while the small *psos* tendon normally lies flattened laterally in the few cases of contracture which I have seen it was flattened anteroposteriorly as though there were a greater degree of spasm

in the median portion of the tendon and its fibers thus elevated as they tend to occupy a position which represents the shortest distance between their origin and insertion. This is apparently corroborated by the fact that the median fibers separate more widely when severed than do the lateral. The tendon presents a rather sharp cardboard-like edge, well calculated to obstruct the cecal current as the bowel may be found lying across this edge, the posterior cecal surface being projected forward the distal and proximal portions of the gut hanging down each side of the tendon forming the saddle-bag caecum as found in the following case (Fig. 2).

Cas. Female, age 25 had complained of progressive discomfort in the right inguinal region several years. In December 1907 she was brought to the hospital suffering from an acute suppurative appendicitis so extensive that drainage was employed. There was some subsequent infection of the abdominal wound, but recovery was uneventful.

In 9 she returned from Ohio complaining of pain, churning and tenderness in the right inguinal region. Standing or walking the body inclined forward and slightly to the right and while in the recumbent posture the right thigh was abducted (Fig. 3). Constipation was extreme. In interrogation elicited the information that these symptoms though in a less degree, were noticed prior to her operation for appendicitis. They were

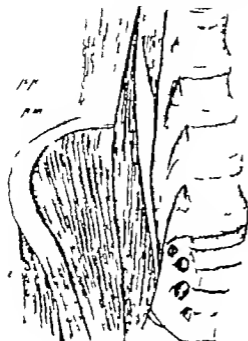


Fig. 3. p p, psoas paries, p m, psoas major, i, iliac vessels.

steadily growing mass and she desired relief. Bearing in mind the extent of the suppuration when operated upon previously, the drainage and wound infection we naturally thought that post-operative adhesions caused her complaints. Consequently the abdomen was reopened, the gloved forefinger introduced and swept along the margins of the wound for adhesions, but there were none. The initial movement of the finger brought it in contact with the dense psoas tendon, its sharp glistering edge directed anteriorly and pressing into the under surface of the circum, practically occluding its lumen, and forming a dam over which the contents of the gut made its way with difficulty.

The peritoneum overlying the contracture was cut through parallel with the tendon which was then cut transversely separating adely with snapping force. Coincident with this flexion of the thigh—which was maintained in spite of the anesthesia—was abolished and the right leg assumed position similar to the other. The peritoneum was sutured over the severed tendon and the abdominal wound closed. Recovery and prompt subsidence of symptoms.

To this patient a pleasing and somewhat surprising feature of her convalescence was the discovery that her right thigh was no longer flexed and that, contrary to the post-

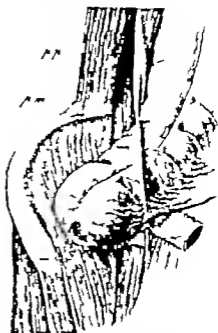


Fig. 4. The middle bar, circum, p p, psoas paries, p m, psoas major, i, iliac vessels. (The approach had been removed at previous operation.)

operative rule her bowels moved without assistance even while lying in bed (Fig. 4). This case is not the most typical, but it illustrates the tendency to attribute right inguinal symptoms to post-operative adhesions. And it is quite possible that abnormal cecal membranes, mobility and kinks, which presumably have been overlooked during operation, have sometimes been unjustly blamed for symptoms which persist after operations for appendicitis and perhaps tubal and ovarian disease as well.

Illumination of this, and also showing the tendency to put unjust blame upon the previous operation, is the following:

CASE. Mrs. D. age 30. Mulipara. Some what neurotic. Had been operated upon by competent surgeon years ago for bilateral inguinal hernia, and through the small incisions he shortened the round ligament for retroversion. Since convalescence she has suffered continuously with pelvic distress, especially in the ovarian region and at menstruation, using which morphine had been employed habitually. She also complained

of discomfort in standing or sitting erect or lying with the thighs extended. There was bilateral pelvic tenderness on palpation also tenderness over the appendix uterus in the anterior position. The patient, her family and family physician condemned the previous operation and held it responsible for all the subsequent symptoms. We contended against this, first general principles and second, because tubo ovarian as well as appendiceal disease seemed distinctly manifest. Attention was called also to the probability of psoas tendon contracture. The abdomen was opened in the median line the uterus shown to the doubting family physician, in good position. There was small ovarian cyst on the right and which was resected, small bilateral cyst on the left both ovaries hung too low in the pelvis their ligaments were shortened. The vermiform appendix was removed being markedly inflamed, bent upon itself and adherent. Jackson membrane was present in a mild degree. Both psoas parvus tendons were contracted. The overlying peritoneum was incised and the tendons cut cross. Convalescence satisfactory with immediate relief of pain, soreness, and thigh flexion.

I am inclined to the belief that it is well to examine for psoas parvus contracture when operating for other lesions in this area.

The existence of thigh flexion and even pain down the thigh before operation cannot be depended upon to draw our attention away from disease of the appendix because they are so frequently associated with it.

The following is the variety which will probably be seen most commonly.

CASE 3. Female, age 34, was referred to the surgical department suffering with appendicitis. No gastric or febrile symptoms, but localized pain, tenderness, and muscular rigidity. There was past history of right-sided distress gradually increasing in severity. The abdomen was opened over the appendix which was found clotted and moderately engorged, but not sufficiently inflamed to account for the symptoms. As the finger was introduced and swept inward to hook up the cecum and appendix encountered the tense psoas tendon. The corresponding tendon of the left side was examined for comparison and found to be normal. The appendix was removed then the peritoneum peeled off from the outer edge of the abdominal incision — and turned up from the glistening tendon — as one might expose the ureter. The tendon as severed, evoking sharp snapping sound and separating an inch and one half. Recovery with prompt subsidence of symptoms.

CASES 4 and 5 are so nearly identical with the one preceding that narration in detail may be omitted. Case 5 differed only in the presence of moderate sized tubo ovarian mass which was removed with the appendix through McBurney



Fig. 3. The characteristic thigh flexion. Before operation.

Fig. 4. Prompt abolition of thigh flexion. After operation.

incision — not the most convenient method but still quite feasible.

The second case is the only one among these which was not regarded as appendicitis or appendicular sequela. When the median incision is employed, as in this instance it becomes necessary of course to open the peritoneum resting upon the tendon rather than to expose the tendon by peeling up the peritoneum from the wound edge.

In the first case the contracture existed prior to and coincident with the suppurative appendicitis, but was obscured by adherent intestines and omentum and even if discovered no attempt should have been made to deal with it at that time.

#### SUMMARY

1. The pre-operative flexion of the right thigh is so frequently a symptom of inflammation of the vermiform appendix that it seems to confirm this diagnosis.



Fig. 3. The right side of the abdomen. p.p. points to the incision, p.m. points to the incision.

Fig. 4. The right side of the abdomen. p.p. points to the incision, p.m. points to the incision. (The appendix had been removed at previous operation.)

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Illuminative of this and also showing the tendency to put unjust blame upon the previous operation is the following.

CASE 2. Mrs. D. age 39. Mitigations. Some what neurotic. Had been operated upon by competent surgeon, year ago for bilateral inguinal hernia, and through the inguinal incisions he shortened the round ligaments for retroversion. Since on account she has suffered continuously with pelvic distress especially in the ovarian region and menstruation during which morphine had been employed habitually. She also complained

of discomfort in standing or sitting erect lying with the thighs extended. There was bilateral pelvic tenderness on palpation also tenderness over the appendix uterus in the anterior position. The patient, her family, and family physician condemned the previous operation and held it responsible for all the subsequent symptoms. We contended against this first, on general principles and second because tubo-ovarian as well as appendiceal disease seemed distinctly manifest. Attention was called also to the probability of psoas tendon contracture. The abdomen was opened in the median line the uterus shown the doubting family physician in good position. There was small ovarian cyst

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Fig. 3 The characteristic thigh flexion Before operation

Fig. 4 Prompt abolition of thigh flexion After operation

I am inclined to the belief that it is well to examine for psoas parvus contracture when operating for other lesions in this area.

The existence of thigh flexion and even pain down the thigh, before operation cannot be depended upon to draw our attention away from disease of the appendix because they are so frequently associated with it.

The following is the variety which will probably be seen most commonly.

**CASE 3.** Female age 24, nurse referred to the surgical department suffering with appendicitis. No gastric or febrile symptoms, but localized pain, tenderness, and muscular rigidity. There was past history of right-sided distress gradually increasing in severity. The abdomen was opened over the appendix which was found clubbed and moderately enlarged but not sufficiently inflamed to account for the symptoms. As the finger was introduced and swept inward it hooked up the cecum and appendix it encountered the tense psoas tendon. The corresponding tendon of the left side was examined for comparison and found to be normal. The appendix as removed then the peritoneum peeled off from the outer edge of the abdominal incision — and turned up from the distending tendon — much as one might expose the ureter. The tendon was severed, evoking a sharp snapping sound and separating an inch and one half. Recovery with prompt subsidence of symptoms.

**CASE 4** and **5** are so nearly identical with the one preceding that narration in detail may be omitted. Case 5 differed only in the presence of a moderate sized tubo-ovarian mass which was removed with the appendix through McBurney

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In the first case the contracture existed prior to and coincident with the suppurative appendicitis, but was obscured by adherent intestines and omentum and, even if discovered, no attempt should have been made to deal with it at that time.

#### SUMMARY

1. The pre-operative flexion of the right thigh is so frequently a symptom of inflammation of the vermiform appendix that it seems to confirm this diagnosis.

2 In the cases of moderate contracture complete thigh extension may be possible but painful. Restriction is definite.

3 In the suppurative cases of appendicitis the contracted tendon may really be overlooked because of the importance of terminating the operation at the earliest moment, of indulging in the least possible intra-abdominal manipulation, and because bowel and omental adhesions supervene.

4 It may not be significant but in each case the psoas parvus tendon on the other side was examined and found normal except in Case 2.

5 The cardboard-like edge of the shortened tendon is capable of damming—to a most troublesome degree—the cecal current, the relief of constipation after tenotomy being quite noteworthy even while the patient is lying in bed.

6 At present the stripping up of the peritoneum from the outer edge of the abdominal wound as though to expose the ureter

seems satisfactory and feasible for exposing the tendon for tenotomy when the abdomen is opened through the oblique incision.

7 Prompt relief of the symptoms may be expected after complete tenotomy.

8 In the post-operative cases the leaning attitude of the patient may well suggest adhesions.

9 The persistence of thigh flexion under anesthesia is characteristic.

10 All of these patients were inclined to be neurotic.

11 It now seems somewhat strange that in a hospital service of eighteen years similar cases have not been encountered before, which suggests that it is wise to exclude this lesion when operating in the lower abdomen.

12 The unsuspecting attitude of both medical attendants and surgeon is emphasized by the fact that the only instance in this short series wherein the contracture was even suggested before operation was in Case 2, which was the last one seen.

## SARCOMA OF THE ROUND LIGAMENT OF THE UTERUS

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From the Department of Gynecology and Obstetrics, Washington University Hospital

TEN years have elapsed since Emanuel gave his thorough review of tumors of the round ligament of the uterus.

Including his own, Emanuel was able to collect 80 cases altogether. The observation of a very interesting and unusual type of round ligament tumor, a spindle-celled sarcoma, induced me to review the literature of the last ten years to see what light if any the additional cases recorded during that time might throw upon the pathology and symptomatology of this condition. Without going exhaustively into the literature, I was able to collect 61 additional reports, including my own, making a total of 141 round ligament tumors. A number of these cases are doubtless never reported. Thus I recall assisting the late Dr. A. C. Bernays in an operation in the year 1899 at the St. Louis Female Hos-

pital upon a negress who had a round ligament tumor the size of a child's head lying in the left inguinal canal. Microscopic sections of the tumor made by Dr. Carl Fisch revealed what he termed a fibromyoma. Macroscopically the tumor resembled a fibromyoma.

The report of my own case is as follows:

Mrs. M. G., 44, married, entered the hospital October 27, 1905, because of protrusion from the vagina associated with itching and soreness in the lower abdomen.

*Family history.* Negative.

*Past history.* General health good. Very nervous at menstrual periods.

*Menstrual history.* Began at 13, twenty-eight day type, lasts three to four days, profuse, regular, considerable pain. Last menstruation October 24, three days.

Married nineteen years, had seven children, oldest seventeen years, youngest four years, three now carriers—but one 6 years ago, no instrumental



Fig. 1. Tumor cut along its greater diameter showing lobulated structure, telangiectatic areas, and several small cysts.



Fig. 2. High power section from sarcomatous node at base of tumor showing character of cells and well formed blood supply.

deliveries was torn with first child; no trouble after the miscarriages.

After the birth of her fifth child ten years ago she noticed some dragging in the pelvis and a slight vaginal protrusion. This became more pronounced after the two succeeding confinements. About one year ago the patient says she felt something come down and protrude from the vulva. Finally about a month ago the protruding mass was so large as to interfere with walking. When off her feet the mass lay in the pelvis. There had been some backache and soreness in lower abdomen.

Bowels regular; no frequency or burning on urination; no history of gonorrhea or leucorrhoea; well good appetite.

**Physical examination.** Well developed well nourished adult. Skin of good color. Arm moist. Left lobe of thyroid enlarged to about 6-4 cm. feels boggy not fluctuating not tender. Systolic murmur loud, blowing loudest at apex and transmitted to axilla. Murmur also heard in vessels of neck. Pulse 70-80, regular, force and rhythm.

**Abdomen.** Good layer of fat flabby. A mass outlined in lower abdomen extending to within one inch of umbilicus; ovoid, hard, movable somewhat to the right side.

On vaginal inspection there is rather free agnathic type pronounced cystocele and some rectocele. On bearing down cervix comes to edge of vulva. At other times, it lies about one and one half inches within the vagina enlarged hard movable from side to side but not backward. Continuous with the posteriorly and to the left of the median line.

besides the body of the uterus crowded down into the cul de sac by a large ovoid mass lying to the right and above it. This mass is slightly irregular in contour and is movable, but on pulling upward strongly pain is elicited. The right tube and ovary could not be palpated distinct from the mass; the left tube and ovary could be felt and were apparently normal.

Blood count: 5,20,000 red, 8,430 white, 90 per cent Hg.

Blood pressure: 130/85, 110/60 diastolic.  
**Diagnosis.** Right-sided ovarian tumor (fibroid pseudomucinous cyst), cystocele, relaxed floor of vagina.

**Operation.** The laparotomy on October 30th under nitrous oxide ether anesthesia, revealed a somewhat nodular mass the size of a grapefruit adherent to the omentum ileum and abdominal wall. No ascites was present. The adhesions between the loop of ileum and the tumor were extensive and firm so that they had to be cut bit by bit. When the tumor was freed from these attachments the uterus, tubes and ovaries could be seen lying beneath it free of all adhesions and perfectly normal except for slight thickening and retroversion of the uterus. The left round ligament was normal in its course and proportions. The right round ligament at its uterine end was slightly thickened and its distance of about two inches from the uterine horn was lost; the tissue of the tumor itself. The round ligament could again be distinguished at its entrance into the inguinal canal. The tumor had a broad pedicled attachment and was apparently entirely covered by peritoneum. Three or four nodules the size of bean lay loosely attached to the main tumor round its pedicle. They resembled in all respects the tissue of the tumor. The tumor was readily

lifted up, clamped off and removed. I view of the apparent malignancy of the tumor I was decided to remove the right adnexa and the body of the uterus. The cervix was then fixed to the fascia and muscle of the abdominal wall. It was thought best to let the peritoneoplastic for a later operation if found necessary. Exploration of the lymphatic glands, intestines, liver, kidney and stomach revealed no metastases anywhere in the abdomen. Closure of incision with two sutures.

Beyond considerable distress with gas pains the patient made an uneventful recovery. At re-examination on December 4th showed no tumor mass palpable in the pelvis. The cystocele was less pronounced but still present.

The specimen removed (Fig. 1) measured 33 by 14.5 by 9 cm. was ovoid, somewhat lobulated in shape and contained few loosely attached nodules the size of a bean. Two of these nodules were put in Zenker's fluid to cover. The remainder of the specimen was fixed in formalin. The whole tumor had jelly like consistency. It was studded with numerous cysts containing serous fluid and lying in case from post walnut. On section it showed lobulated structure and smooth cream or butter color. At the base of the tumor could be seen a small area of fibrous connective tissue which appeared to be the remnant of the round ligament.

Microscopic sections taken from many portions of the tumor confirmed the diagnosis of a spindle celled sarcoma. There was very little connective tissue as reticulum for the tumor cells. The cells themselves were fairly regular in shape, being either ovoid or spindle shaped, and had deeply staining nuclei. The blood supply was unusually well developed (Fig. 2) and indicated the slow growing character of the tumor. The cysts proved to be of lymphatic origin, as shown by their endothelial lining and structure. No evidence of epithelial structures of any sort could be seen. This is of importance in view of the frequency with which they have been found in round ligament tumors.

The covering of the tumor as shown in Fig. 3 to be a serous membrane identical in structure with the peritoneum. In this section can also be seen several small cystic formations in the tumor itself.

That the tumor actually springs from the tunics in or around the round ligament is substantiated by the microscopic picture shown in Fig. 4. Here we see the fibromuscular tissue of the ligament at the base of the tumor actually lying itself in the nests of sarcomatous tissue. Sections stained according to Van Gieson showed that large proportion of this band as composed of bundles of striated muscle tissue.

**General considerations.** The sixty-one additional cases exclusive of the above published since 1903 are those of Alchell, Alfieri, Albert, Amann (2), Baudet, Blaser, Boonin, Bort, Lewitach, Chevroux, Colloc, Davidson, Fin-

sterer, Frankl, Friedrich, Frigyesi, Fukada, Gottschalk, Hirst and Knipe (3), Hult, Kaiser, Klemens (7), Kolb, Lecene, Lewis (2), Lubentz, Lisschenka (3), Maly, Mantelli, Morestin, Muenchmeyer, Nebeaky (2), Schauenstein, Schlank, Soli, Spencer, Stekl, Snh, Tietmeyer, Venus, Weishaupt (4), Winckel, Wiener, Wood, Zelli, Zurmuehlen. This makes a total of 133 round ligament tumors for our consideration.

**Age of patients.** Since most of these tumors resemble in point of origin, fibroids of the uterus. It is not surprising to find that a large majority of them appear in patients between thirty and fifty year of age. Winckel's tumor however was found in a woman of seventy six and Alchell's was observed in a new-born child. Between twenty and thirty and between fifty and seventy years they occur with less frequency.

**Location and size.** Tumors may spring from any portion of the round ligament in fact quite a number have been found to spring from the ovarian ligament which may be considered as embryologically identical with the round ligament. The last named group I have however not included in this review. Emanuel found that out of his 80 cases only 20 developed intra-abdominally, the remaining three-fourths being found either in the inguinal canal or in the labial fold. This preponderance of the extra-abdominal site has been corroborated by the cases reported up to the present time. I found 18 intra-abdominal and 30 extra-abdominal making the total proportion 38 intra-abdominal and 90 extra-abdominal. The intra-abdominal tumors arise frequently from that portion of the ligament nearest the uterus and usually grow outward into the peritoneal cavity so that they present the appearance of a pedicled tumor attached to the ligament. Such was the condition in our own case. At times, however they grow into the broad ligament, or if situated near the internal inguinal ring, they may grow sub-peritoneally. A multiplicity of tumors was noted by Winckel, Amann, and Davidson. In Davidson's case both ligaments were studded with many tumors. In one of Culen's cases, after removal of a tumor on one



Fig. 3. Section from margin of the tumor showing peritoneal covering and two small cysts.

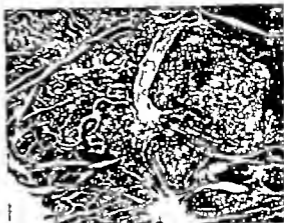


Fig. 4. Section from the base of the tumor showing tumor nests (t), the right and bundles of unstriated muscle fibers (c), the left.

side a second one formed in the other round ligament.

The right side was found by Emanuel to be three or four times more often the site of such a tumor than the left side. In 37 of the additional cases in which data were obtainable the proportion was 30 right-sided to 17 left-sided tumors, so that the preponderance of right-sided growths seems questionable.

The size of the tumors varied greatly, the smallest being but slightly greater than the diameter of the round ligament, whereas the largest extended up to the border of the ribs. On the whole the extraperitoneal ones are larger than the intraperitoneal. Those tumors that begin in the inguinal canal often direct their way between the layers of the abdominal wall or if lying at or about the external ring project into the labial fold and are then classed as tumors of the vulva. It is more than likely that practically all fibroid tumors of this region have their origin in the round ligament.

Since most of these tumors are fibromyomata the shape is usually round or oval but occasionally they are multilocular. In my own case the tumor had numerous small

nodules upon its surface. Owing to the frequency of cystic and telangiectatic conditions in these round ligament tumors it is not surprising that a certain percentage of them have a semisolid or even fluctuating consistency. The rule is however that the consistency is firm.

The symptoms produced are very slight, so that many of the patients state that they felt the tumor for many years but that it gave them no special inconvenience. Intra-abdominal tumors usually go a long time undetected and give rise to the same symptoms as subserous fibromyomata or solid ovarian tumors. If the tumors are not very large so that the ovaries can still be palpated the differential diagnosis can at times be made. Ordinarily this is impossible and in very few instances was the correct diagnosis of an intra-abdominal round-ligament tumor made.

The extra-abdominal tumors are usually mistaken for hernia in the early stages of growth. Later when the tumor becomes larger they may give rise to pressure symptoms, pains radiating down the leg and a dragging sensation. In general instances the tumors were associated with inguinal hernia of varying size. The differentiation from irreducible omental hernial masses and from hydrocele muliebrium is often attended with considerable difficulty. In Klemm's seven cases of extra-abdominal tumors the correct

TABLE I SARCOMA OF THE ROUND LIGAMENT

Name and Reference	Month of age	Sex	Symptoms	Location	Size	Shape	Consistency	Operation	Result
Wright, A. & J. (1904) 11	1 year	F	1. Enlargement of tumor (2 in x 3 in) at site of pregnancy	Right external canal	2 cm	Round like 1	Firm	Removal of tumor	Died on second day
Payson (1904) 11	1 year	F	2. Growth of tumor at site of pregnancy	Left external canal	2 cm	Cylindrical	Hard	Removal of tumor	Recovery
Wright, A. & J. (1904) 11	1 year	F	3. Enlargement of tumor (2 in x 3 in) at site of pregnancy	Left external canal	2 cm	Round like 1	Firm	Removal of tumor	Recovery
Payson (1904) 11	1 year	F	4. Enlargement of tumor (2 in x 3 in) at site of pregnancy	Right external canal	2 cm	Cylindrical	Hard	Removal of tumor	Recovery
Wright, A. & J. (1904) 11	1 year	F	5. Enlargement of tumor (2 in x 3 in) at site of pregnancy	Left external canal	2 cm	Round like 1	Firm	Removal of tumor	Recovery
Payson (1904) 11	1 year	F	6. Enlargement of tumor (2 in x 3 in) at site of pregnancy	Right external canal	2 cm	Cylindrical	Hard	Removal of tumor	Recovery
Wright, A. & J. (1904) 11	1 year	F	7. Enlargement of tumor (2 in x 3 in) at site of pregnancy	Left external canal	2 cm	Round like 1	Firm	Removal of tumor	Recovery
Payson (1904) 11	1 year	F	8. Enlargement of tumor (2 in x 3 in) at site of pregnancy	Right external canal	2 cm	Cylindrical	Hard	Removal of tumor	Recovery

diagnosis was made only three times before operation.

It has been stated that the wearing of a truss for inguinal hernia was a predisposing factor but it is more than likely that the supposed hernia was in reality a beginning tumor formation and that the pressure of the truss naturally irritated it to more rapid growth. Pregnancies which causes such a marked hypertrophy of the round ligaments, would naturally be expected to stimulate such tumors to active increase in size. Such indeed is the case as shown by the cases of Hirst, Kolb, Nebesky and Mantell. It may become necessary to remove such a tumor during pregnancy but ordinarily it is best to wait until after the puerperium.

The most interesting feature of these tumors is their varied pathology. In 135 out of the 141 tumors a statement was given as to the nature of the neoplasm. Seventy-nine of them belonged to the group of fibromyomata, although in some instances (19) they were termed simply fibromata and in other instances (14) were classified as myomata. In 19 tumors there was only a thin shell of fibromuscular tissue surrounding a cyst and three of these cysts contained blood and were classified as hematomata. Occasionally the cysts were multilocular. One unique case is re-

corded by Fischer of a dermoid cyst springing from the left round ligament.

The most striking fact in the pathology of round ligament tumors is the comparative frequency of adenomyomata. Cullen found that out of a total of 1283 cases of myoma of the uterus examined at Johns Hopkins Hospital between 1893 and 1906 73 or 5.7 per cent were adenomyomata. The proportion among round ligament tumors, on the other hand, was 30 out of a total of 135 or 22 per cent that is to say they are relatively four times as frequent at this site. This may perhaps be due to the close relationship between the Wolffian duct and the nephrogenic band extending almost the entire length of the embryo. It is from the latter according to Krimmer's latest investigations that the round ligament takes its origin. While Cullen interprets his case of round ligament adenomyoma as springing from the Mullerian ducts, his arguments are not very convincing. On the other hand the arguments pointing to the Wolffian origin of these tumors is very considerable. Chevers found a distinct kidney glomerulus in his adenomyomatous tumor. Robert Meyer could trace in a considerable number of round ligaments of the newborn an epithelial lined duct corresponding to the Wolffian duct. Frank's case

of a small adenomyoma of the abdominal portion of the round ligament was associated with a uterus bicornis unicollis. Venus found an epithelial duct in the normal portion of the round ligament in which was contained an adenomyomatous tumor. Almost all those who have made careful microscopic studies of their tumors lean toward the interpretation of a wolffian origin.

In view of the rarity of sarcomata and the fact that my own tumor was of this type I have thought it worth while to tabulate the six cases of this kind thus far recorded. The case mentioned by Hirst and Knipe contains no details as to histopathology or other important clinical facts. I could not obtain accurate information concerning the large sarcoma of the round ligament reported by Fukada. That leaves only the cases of Saenger, Fuerst, Weber, Griggs, and May, in addition to my own. Details of these cases will be found in the accompanying table.

In general these round ligament sarcomata may be described as slow growing and but slightly malignant clinically. Metastases are nowhere described nor was I able to find any record of recurrences after operation. The tumors do not seem to grow to any unusual size and are most often extra abdominal. Only one post operative death occurred and that was in the first recorded case thirty years ago. In all but my own case the tumors were apparently malignant degenerations of a benign neoplasm a fibromyoma. Microscopic examination of the tumor in my case gave no evidence of any previously existing benign tumor.

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# DEPARTMENT OF TECHNIQUE

## A PROCEDURE FOR THE REPAIR OF ACCIDENTAL INJURIES TO THE RECTUM

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It sometimes happens that the rectum is injured during the course of a pelvic operation. That this accident is by no means an infrequent complication of the extensive operations for radical extirpation of the uterus and adnexa for uterine carcinoma is apparent from the published report of Bumm, Sigwart, Schauta, and others. The wide parietal dissection and the desire to remove as much of the upper vagina as possible renders the anterior rectal wall particularly exposed to injury. During the excision of the uterus with vagina the anterior rectal wall is pulled upward and forwards—not unlike a cone—and as the incision frees the mass, the apex of the rectal cone is cut off, leaving an elliptical defect in the anterior rectal wall. Closure of a hole in the rectum in this location is a matter of technical difficulty. First the injury is at the lowest portion of the pelvis and practically inaccessible for accurate suture work. Secondly, the rectum in this position is relatively fixed and not flaccid. Thirdly it is difficult to approximate the peritoneal surfaces over the defect.

It was our misfortune during the course of a Wertheim operation to injure the rectum in the above-described manner.

CASE. M. G. (sister of Dr. Geo. Gray Ward, J.) Age 31 entered the New York Post-Graduate Hospital on May 11, 1915 complaining of pain on her left side with excessive bleeding. A diagnosis of carcinoma uteri as made and radical operation advised. On May the fifth typical Wertheim as performed (considerable difficulty) as experienced in separating the rectum on the left side and in placing the sigmoid clamp portion of the anterior rectal wall as grasped. When the uterus and parametria were extirpated there was an elliptical defect in the anterior rectal wall low down behind the posterior vaginal flap. An attempt was made to close the rectal hole on after the ordinary method of exterior clamping. This was unsuccessful the sutures tearing out and peritoneal approximation being extremely questionable. I overcame this difficulty recourse was had to the following technique, which is a modified application of the well known and widely used tube technique for

sigmoidorectal anastomosis, as described by Gibson and Ballou. Variation the steps are as follows:

*First step.* A colon tube is introduced into the anus and passed up the rectum to a point one inch above the injury (Fig. 1). Through the anterior rectal wall and the portion of tube above the injury a transfixion suture of number two chromic gut is passed which firmly anchors the tube to the upper portion of the anterior wall.

*Second step.* The peritoneum on each side of the defect and parallel with the rectum is incised for a distance of about two and a half inches. By this manoeuvre the upper rectum becomes mobilized, after the manner of Kocher for mobilizing the duodenum (Fig. 2).

*Third step.* By gentle traction on the tube protruding through the anus the two lips of the rectal defect are brought together and approximated by three or four interrupted mattress sutures (Fig. 3).

*Fourth step.* Two Allis clamps, one on each side are placed about one-half to three-fourths inch below the suture line for the purpose of fixing the lower segment (Fig. 3). Traction is made upon the tube and as a result the upper segment of the anterior rectal wall telescoped into the lower rectal segment. There is thus produced an artificial intussusception of the anterior rectal wall. The original defect or injury is carried down into the lower bowel and by the rolling in of the anterior rectal wall a peritoneal approximation is secured (Figs. 3 and 4).

*Fifth step.* A right angle Cushing suture of Pagenstecher thread is passed along the site of peritoneal contact (Fig. 3) completing the repair of the rectum. The lateral peritoneal defects are closed and the tube sutured to the anal margin with silk worm gut, thereby making gentle but firm traction on the upper rectal segment.

The post operative conduct of the rectal condition was as follows. The tube was removed at

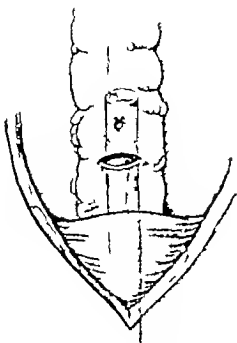


Fig. 1 Injury to rectal wall tube passed one inch above injury and held *in situ* by transfexion suture

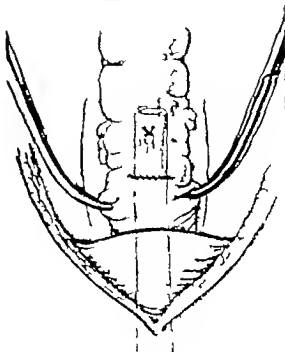


Fig. 2 Transfexion suture passed. Traction on tube approximates the two lips of rectal defect. Lateral incisions through peritoneum for mobilization of upper rectum. T. Allis clamps on lower segment to keep it taut

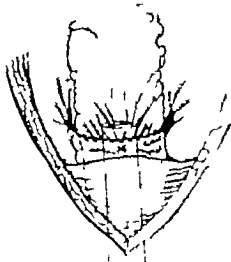
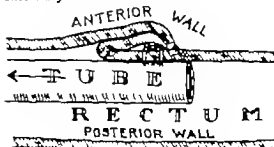


Fig. 3 Upon traction on tube upper segment telescoped out lower Right angle Combust suture—approximating peritoneum

the end of five days and the patient then given milk of magnesia (four ccm) every hour for six doses. This was repeated on the sixth day and on the morning of the seventh day the patient had a normal evacuation. No enemata were given during the time the tube was *in situ*. Gases and fluid stool were intermittently discharged through the tube. From the time the tube was removed the patient had no rectal disturbance of any kind either subjectively or objectively and the bowels moved on an average once a day.



It is worth recording that before recourse was had to this method of closure the ordinary method was attempted but the traction upon the sutures was so great and their insertion so inaccurate and insecure that the result would have been very dubious. However by adopting this simple device it was surprising to see how easily and securely the closure was effected.

We have found the above technique very useful in closing other forms of accidental injuries to the rectum. In a case of morcellation of a fibroid uterus, as a preliminary measure the pararectal incisions of Schuchardt were made and the left incision accidentally opened the rectum rather high up. From the peculiar antero-lateral position of the injury it offered considerable difficulty to the ordinary method of closure but could, however have been so repaired. The injury was readily closed by the adoption of the above technique. Again in doing the denuda-

tion, preliminary to a perineorrhaphy the anterior rectal wall about two inches above the anus was incised. The defect was readily closed by the application of the above technique with no post-operative fecal leakage into the perineum.

#### CONCLUSIONS

- 1 The splint-like action of the tube is a decided advantage—holding the suture line intact.
- 2 The indentation of a partial intussusception allows accuracy of suture and approximates similar surfaces.
- 3 The separation of the two suture lines by intermediate normal tissue insures against leakage.
- 4 The technique is easy of application and converts a difficult complication into one that can be repaired with comparative ease and effect.

## ON THE TECHNIQUE OF INTRATHORACIC OPERATIONS

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ALTHOUGH the technique of intrathoracic surgery has been very much improved during the last few years, complications still often follow upon operations on the lungs, the esophagus, and the heart. For this reason the technical details by means of which intrathoracic operation may be rendered more safe must be worked out. The purpose of this paper is to describe the methods by which the occurrence of pleurisy and of air emboli of the coronary arteries can be prevented.

It is probable that the development of pleurisy is always due to infection or irritation produced by the handling of the pleura with sponges or instruments by the contact of the blood or by the germs of the air. Most experimenters and surgeons in their operations on the pleura employ the same technique which is used in abdominal surgery. They do not realize that the pleura is very much more liable to infection than the peritoneum and that the mechanical irritation, as well as certain factors of infection, such as the atmospheric germs, are possibly able to produce dangerous complications. Several years ago I read a paper before the members of this Society, in which that question was already investigated

and in which the details of a technique for the prevention of these mild but very dangerous infections were described. At that time great care was taken in handling the intrathoracic organs, in sponging and washing off the operating field with gauze and in protecting the pleura from the various factors which bring about irritation and infection. As soon as the thoracic cavity was opened the lungs were covered with fine silk compresses impregnated with creosote. The silk tissue acted as a thin and almost impermeable membrane which protected the pleura without irritating it and permitted an efficient washing off of the operating field to be effected. At the same time it prevented the evaporation and the desiccation of the surface. Of twelve animals operated at that time all eleven recovered. Nevertheless, after more complicated operations, such as the patching of the empyema, the grafting of vessels onto the heart and descending aorta, it was observed, when a large exposure of the thoracic cavity was rendered necessary that serofibrinous or purulent pleurisy was eventually present. In 28 operations performed these complications occurred 7 times.

Although these experiments were made a long time ago it appears that the technique for the prevention of pleurisy has not been further developed as yet. Both American and European surgeons are still describing more or less complicated methods for the drainage of the pleura. This evidently shows that pleurisy is still an ordinary complication accompanying intrathoracic operations. For this reason I have again attempted to ascertain whether in experimental operations this complication could be entirely avoided.

The use of Japanese silk towels impregnated with vaseline had already in a large measure diminished the danger of the occurrence of pleurisy but it was nevertheless probable that the silk membrane did not sufficiently protect the remoter parts of the pleural cavity. Moreover when hemorrhage occurred the blood flowed along the greased surface of the pad and accumulated in the lower part of the thoracic cavity. For this reason the technique had to be modified and this was effected in the following manner. The operating field was walled off by two kinds of towels. The first kind was made of Japanese silk which had been previously boiled in water dried and sterilized in the autoclave like ordinary pieces of dressing. The second kind was composed of also bent cotton and of black Japanese silk. These towels were made in the following way. Two pieces of fine black Japanese silk were sewn together at the edges. Between these two pieces was placed a layer of absorbent cotton about one centimeter thick and the whole towel was knotted throughout thus forming a pad. These towels were sterilized in the autoclave. Both kinds of towel above described were used for walling off the operating field. When the incision of the superficial part of the thoracic wall was completed and the hemostasis secured, the pleural cavity was opened by means of a small incision made in the middle of an intercostal space. A dry white Japanese silk towel was introduced into one end of the incision while a second one was introduced at the other end. These towels afterwards served as a protection to the anterior and posterior parts of the pleural cavity. Next, the incision of the thoracic wall was completed and the thoracic cavity was opened wide the lungs being meanwhile completely protected by the towel already introduced. Immediately after this the black silk and cotton padded towels were laid on the upper and lower edges of the wound and introduced into the cavity in such manner that they respectively protected the upper and

lower parts of the pleura. Next, a Gosset retractor was applied and the edges of the wound were retracted as much as was necessary for the purpose of the operation. The edges of the padded towels were arranged in such a way as to circumscribe the operating field and to leave this alone exposed to the air and to the sight of the operator. Additional padded towels could be used afterwards, if necessary in order to secure a more complete walling off of the operating field. By means of this procedure the pleural cavity appeared to be almost completely protected against the infection produced by the atmospheric germs, as well as against all possible infection or irritation caused by the handling of the serous membrane by the hands of the operators, by the rough sponging with gauze and by other operative traumatizations. Moreover when hemorrhage occurred the blood was prevented from flowing into other parts of the thoracic cavity.

The technique described above was recently used in eight operations of the patching of the pulmonary artery and the incision of the pulmonary orifices, in six operations of cauterization or incision and the suturing of the sigmoid valves and pulmonary orifice, and in one operation of the cauterization of the sigmoid valve of the aorta. In two cases the animal died on the operating table and in one case in which rubber gloves were not used for the handling of the heart and pericardium the animal died a few days later of pericarditis. The two other animals remained in good health. These results thus demonstrate that in stenotic operations in the thoracic cavity which are often accompanied by hemorrhage from the heart the pleura can be efficiently protected and intrathoracic operations may consequently become as safe as operations on the abdominal cavity.

The general principles used in blood vessel surgery are sufficient for most operations on the heart and complications such as thrombosis or hemorrhage can be completely prevented by employing a technique more or less similar to that used for the suturing of large blood-vessels. Nevertheless there is one complication which often causes death in intracardiac operations and this is the occurrence of air emboli. When the heart is opened wide and closed again by suture it remains filled with air and when the circulation is reestablished the blood carries with it a number of air emboli. In operations performed on the right heart or on the pulmonary artery these air emboli did not appear to have any injurious effects but after the left cavities of the heart or the aorta had been opened and the wall again

closed by suture the re-establishment of the circulation was always accompanied by the entrance of air emboli which were usually most dangerous. A more or less large quantity of air according to the nature of the operation, entered the mouth of the coronary arteries and produced small air emboli in the terminal branches. They could easily be seen in the lumen of the vessels and appeared in the form of small air bubbles which filled the ramifications of the arteries. The circulation of the territory lava led by these air emboli was not re-established the muscle remained bluish in color and the heart was unable to recover its normal pulsation. Usually fibrillary contractions occurred a short time after the re-establishment of the circulation and this was followed by the death of the animal. This above complication occurred every time the left ventricle or aorta was widely opened and the air was allowed to penetrate the cavities of the heart. It was evident that some procedure serving to prevent the occurrence of air emboli had to be devised before it would be possible to perform intracardiac operation on the left cavities of the heart. The method selected consisted in aspirating the air contained in the heart after the suture of the wall had been completed and before the forceps used to clamp the pedicle of the heart was removed. The aspiration was effected in two different ways. According to the first procedure needle was introduced into the left ventricle from where the aspiration was effected. In the second instance a curved glass cannula was introduced through the line of suture of the aorta as far as the aortic orifice and the air was aspirated. By using both these methods the heart could be emptied of air and the production of air emboli after the re-establishment of the circulation was prevented. As, however, the method of eliminating the air by means of aspiration was often imperfect a further method had to be devised

whereby the occurrence of air emboli might not only be prevented but also remedied.

In cases where a great deal of air has entered the coronary arteries no treatment at all would be of any use. If most of the branches of the arteries are filled with air bubbles the fibrillary contractions appear almost immediately after the re-establishment of the circulation, in which case it is probably too late to apply an efficient method of treatment. Nevertheless, it is not impossible that even in these cases the recovery of the heart can be effected if the air emboli can be removed. The technique to be described was only used in cases in which small amounts of air had been injected into the coronary branches. It is well known that the puncture of an arterial wall with a needle No. 26 is followed by hemorrhage but that this hemorrhage always stops spontaneously after a short time. By introducing a needle No. 26 obliquely under the visceral pericardium and by perforating the wall of the coronary artery hemorrhage was produced and the air was eliminated at the same time as the blood. This is but a slight sub-pericardial hemorrhage which is without danger and is easily arrested. As soon as the air had been aspirated from the lumen of the artery a normal circulation through the coronary system was re-established and the heart immediately resumed its normal pulsations. The prevention of the occurrence of air emboli and their treatment adds greatly to the safety of the operations performed on the cavities of the heart. It eliminates one of the chief causes of fibrillary contraction and subsequent death following upon intracardiac operation.

It is certain that these new methods of procedure do not suffice to eliminate all danger from a thoracic operation but that all event they add some important factors of safety to the technique of the operations of the heart and lungs.

AVULSION OF THE SCALP<sup>1</sup>

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THE blood-spattered pages of American history up to the time the frontier disappeared, show that surgeons were not unfamiliar with scalp accidents. The American Indian, unlike the head hunting savages of Borneo and the Philippines, took along the scalp of his victims as one of the trophies of his success in warfare.

Since the first recorded case by Downs, in 1838, surgeons have learned to think of scalping as those cases which were the result of accidental injury — the cases of industrial scalping so called.

Usually the patients are young women working in factories whose hair becomes entangled in a revolving shaft which violently jerks the scalp from the head.

These cases are not extremely rare. Da is in an exhaustive study of the literature collected 9 instances of complete avulsion of the scalp, 81 of which were caused by machinery, 7 by Indians, and 4 by other forces. Of the 8 industrial scalpings, 80 were women and the other a Chinaman with a quene.

The student of this condition is impressed with the great length of time these dreadful wounds take to heal even though they are given the benefit of modern treatment. In the earlier records, cases are reported which took from two to four years to cicatrize, and on instance is cited by Syme which was still unhealed after eight years. An analysis of twenty five reported cases, treated since the technique of skin-grafting became perfected, still shows that an average of ten months treatment was necessary to cover the denuded head.

The anatomical structure of the cranium and its coverings explain in large measure this protracted healing period. The scalp is usually torn away through the subaponeurotic layer leaving the pericranium bare, or part of this latter membrane may itself be taken. The outer layer of the skull, unlike most other bones, is nourished largely by the blood vessels of the diploe; the pericranium plays but a minor rôle in its nutrition being very thin and but slightly vascular therefore granulations are long time in forming on it.

When the skull is laid bare there is frequently necrosis and exfoliation of the outer table granulations form in the vascular diploe and lift up

the thin layer of bone above, which can readily be scaled off.

When granulations do form on the denuded bones they begin at the suture lines where the pericranium as the intersutural membrane dips between the bones to join the dura. These granulations then very slowly spread over the bony tables to finally coalesce and form a new scalp of granulation tissue. Epithelization must perforce, begin at the skin edges and spread from them over the entire dome of the head.

Is it any wonder then that prior to the age of antiseptics, asepsis, and skin grafting many of these patients died of sepsis meningitis, or erysipelas? When we study the blood supply of the scalp and the emissary veins and the intercommunication of its arteries and veins with those of the diploe, dura, and dural sinuses, the marvel is that all of these cases do not die of meningitis or cerebral abscesses for they are all primarily septic.

In most of the reported cases of complete avulsion the integument was torn where it was thinnest, at the level of the brows, or even from the eyelids themselves the direction of force being exerted from before backwards and the superciliary ridges acting as the wedges which caused the cleavage. Fourchard has demonstrated this in experimental avulsions upon the cadaver. Generally the entire scalp to the level of the ears is torn away — occasionally one or both ears as well are lost the defect usually ceases at the hair line on the neck. Cushing observes that it is able to run down on to the center of the neck in a V.

The scalp usually separates from the temporal muscles, leaving them intact the bellies of the occiput frontalis, however are generally taken with it. Hemorrhage is frequently free and occasionally has required ligation of the blood-vessels shock is sometimes profound, but if death occurs primarily it is due to hemorrhage or to other injuries.

Primary pain is rarely severe but several hours later may be excruciating. After granulations are well established there is little or none. These patients frequently suffer from the prolonged suppuration, nephritis may result, and they are wasted and anemic.

Elaborate reports detail the effort of many



Photograph 14. March 30, p. 3. Posterior view showing the site of the graft. Part of old scalp still remaining.

men to cover the large defect present. Keene states that success has attended skin grafting upon the bare bones of the skull this seems incredible when we consider the necessity of an adequate blood supply to keep the grafts viable.

Repeated efforts have been made to graft alien, or xodermic grafts upon the granulating areas, with 100 per cent of failure, for while a few observers report that lamb skin apparently took it in amply sloughed instead of a few weeks.

Thirteen surgeons have stitched the shaved scalp back over the defect and with but one exception (and that is doubtful) reported complete sloughing of the scalp.

Others report cutting the shaved scalp into strips and grafting it as such with general failure.

Hundreds, even thousands, of Reverdin grafts have been used on the same individual with ultimate healing after a long period of time. Plastic sliding operations are reported where a flap from the neck or side of the face with pedicle attached, has been used to cover the brow or part of the cranium.

Where a ulsion was not complete and but the vertex was denuded, after the method of Volkman, four concentric flaps from the edges of the scalp were cut, slid across the wound and united,

making a cross of scalp, the defects between the arms of which were grafted in other ways. Whole thickness graft after the method of Wolfe-Kranke were used by Davis with complete success.

It is by Thiersch method however that the greater number of wounds have been healed, and autogenous grafts have given the best results, the two grafts doing well for a time but ultimately are liable to break down in ulceration, probably the new blood supply over the skull being less perfect than in other parts of the body where approximately 50 per cent of these grafts take.

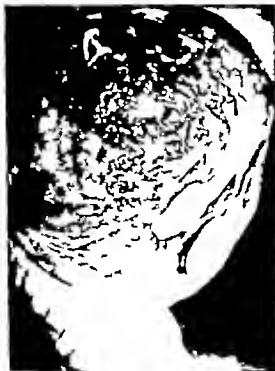
In the case the writer reports, in conjunction with Thiersch grafts, amniotic membrane both from the eye and the cord near the fetus (after the method advised by Stern) was used in three different instances to cover small granulating areas. Two of them definitely took, the third sloughed. Carried a success with the transplantation of refrigerated tissues which has been kept in paraffin for several days or longer would suggest that this method be tried with whole pieces of scalp or skin.

While a large number of surgeons exhausted their ingenuity in the treatment of this condition, it seems to have escaped their notice that a frontier army surgeon as early as 1796 advocated a procedure which greatly simplified and shortened the time of treatment. James Robertson (as quoted by Felix Robertson in 1866 in the Philadelphia Medical and Physical Journal) advocated boring the outer tables of the skull with a trepan and to let the granulations through from the vascular diploe this procedure as suggested to him by an unknown French surgeon and was a frequent practice when Indian warfare made the injury common, but has been lost sight of as a surgical procedure since as the writer finds no record of its use until Sene in 1890 report using this operation to cover a small defect due to a burn over the left parietal bone.

When the writer's case presented itself the reported histories of long delayed granulations, exfoliation of the outer tables, suppuration and its attendant complications suggested that the method be tried.

His case in detail is as follows:

H. H. female, single, age admitted to my service at the University Hospital from Quaker孟蒙蒙 March 28, p. 3. She gives the following history: On March 19th, she running across separator kept slipping from the dress of her shift she got up near the shaft to put the belt on again her hair caught in the turning shaft and her scalp was jerked off her head leaving her full to the floor. She did not faint but bled profusely. Her father as



Photograph taken May 20, 1935 other side of head 20 days after drill holes were made through the outer table of the skull showing granulations cropping through and different stages of development showing thin veil over the granulations on the occiput due to grafted amniotic membrane

prevent and under telephonic instructions from the doctor put the scalp back on her head and applied hot clothes to it. The doctor arrived an hour and a half later and stitched the scalp in place.

When admitted to the hospital nine days later the scalp was still on her head, over the bare bones of the vertex. It was dried like raw hide and as necrotic around the edges, it had shrunk to one half its original size. The wound commenced in front above the left eyebrow angling across the forehead dropping down on to the right eyeball on the right temple it dropped to the level of the eyebrow skirted the ear, hugged the hair line, round the back of the head ran an inch above the left ear and at the outer edge of the left orbit met another linear wound which ran down on to her cheek and below the lobe of the ear — this wound made a detached triangular flap of scalp, ear and integument which had been stripped up and was attached only by its base. The whole head area was bathed in pus.

She was septic and with hemoglobin of 66 per cent. Her head was dressed with wet gauze run out of sodium solution. On the ninth day after the dried scalp was softened it was removed revealing the temporal muscles already granulating but the entire vertex frontal and occipital regions bare of pericranium, muscle or granulation tissue save for small isolated islands of granulations along the lambdoid suture and on the forehead.

This great wound was daily dressed with the wet sodium



Photograph taken August 3, 1935 Showing patient's entire scalp of transplanted skin

gauze and rapidly became reasonably clean. On April 13, only four days after her injury there were healthy granulations on the forehead and over the temporal muscles. Under ether anesthetic these areas were completely covered with Thiersch grafts taken from her thighs. The bare tables of the skull after puncturing with tincture of iodine were drilled through to the diploe with  $\frac{1}{16}$  inch drill the drill holes being  $\frac{1}{16}$  inch apart and 57 in number. The grafts and drill holes were covered with strips of gatta percha tissue back to front was covered with columbian gauze dressing saturated with normal salt solution.

Drill holes in which the vascular area of the diploe are an added measure to first, for they are then absorptive. Later when the granulation forms they are excretive. This was illustrated by the girl's rapid rise of temperature from normal on the day of operation, to  $104^{\circ}$  the second and third days thereafter. Her eyes, nose and cheeks became edematous and dusky and she was isolated under suspension of entrance.

She remained temperature free ten days when it again dropped to normal. All the grafts took but it was not until the twentieth day that granulations appeared in the drill holes, after that they grew rapidly newbroomed out of the holes and over the bony tables to finally coalesce and cover in the entire denuded area six weeks after the operation. In the meantime the girl developed mild case of diphtheria and was isolated until June 3d. Then the remaining area of the head was covered by Thiersch grafts from her thighs and legs. These as well took in a small area

below the occiput. Each as rubbed off in her sleep, this was again grafted June 1st, and at the same time Wolfe's hair-bearing graft was taken from her scapular area and set into wound created in the new skin over her right eyebrow and stretched there by horsehair suture. This graft healed as did the hair, but about two-thirds of the latter dropped out a month later, probably due to lack of adequate circulation for the hair bulbs—the experience is in keeping with that reported by Lutz and Lothman. July 15th small area one by 1/2 inches over the rectum had broken down and was grafted with amniotic membrane, with success. July 20th small area back of the right ear had broken down, this as well was grafted with amniotic membrane, but did not take and finally healed under scarlet red.

July 25th its small area back had broken down, was again grafted with amniotic membrane and healed. August 5th she was entirely healed and left the hospital. August 10th, or four or one-half months after the primary operation. At the present writing, except for small area on the rectum, the new skin is reasonable permanent and is white.

Appreciating that the average time of treatment for these cases is ten months, this simple operation suggested by the unknown traveling French surgeon during the troubled days of the Indian wars, should take its place as an accepted

surgical procedure which is both time and life saving.

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## ANTERIOR CHOLEDOCHOSTOMY

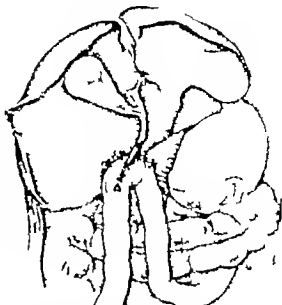
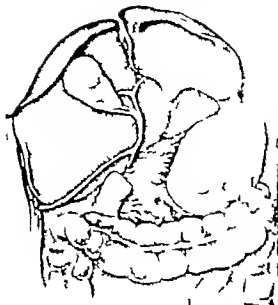
### WITH REPORT OF CASE

B. REGINALD H. JACKSON, M.D., Madison, Wisconsin

**R**ECONSTRUCTION of the common bile duct, as practiced in the experimental surgical laboratories on dogs, is often successful. Theoretically it should be equally feasible in man and doubtless would be practically so if the same conditions could obtain, namely, young, vigorous animals with normal anatomical conditions of organs and tissues. Unfortunately the operative conditions usually obtain when the surgeon is forced to contemplate this procedure. Loss of continuity of the duct due to resection for malignant neoplasm, destruction from gangrenous inflammation following impaction of calculi blighted from cicatricial contractions, etc., all entail such marked alteration in adjacent structures as to jeopardize or at least make problematical the functional civility of an artificially constructed duct. Moreover the debilitated condition in which these cases usually present themselves compels a minimum of operative trauma. Admittedly the interests of the patient are best conserved by the surgeon erecting

the necessary manometers with the least expenditure of time and thus handling commensurate with the proper accomplishment of the object of the operative procedure.

Reestablishment of physiologically active bile duct in man has not been placed in the category of well tried surgical procedures with definite indications and technique. To many who essay it for the first time there comes an undue amount of anxiety and hesitancy in performance, together with the usual doubt as to efficiency when completed. These considerations, engendered by the difficulties encountered in a case of resection of the common duct for carcinoma, followed by reconstruction of the duct (after the method of Sullivan) with lethal termination, prompted me to perchance my next case with considerable reboding. The fact that considerable portions of the duodenum had been removed in a previous operation, thus materially increasing the distance to be spanned by the reconstructed duct, led me in this case to adopt the simple



maneuver of utilizing a more mobile portion of the intestinal canal than the duodenum in its shortened and somewhat atrophied condition offered. A loop of jejunum (that portion embracing its first eighteen inches) was brought up in front of the transverse colon a procedure which has no doubt been used by others.

Mr. G—, age 30, laborer. Referred by Dr. A. G. Rosly, Madison, Wisconsin. Admitted to Madison General Hospital Jan. 4, 1913, service of Dr. Jackson.

*Admitted diagnosis:* *pyloric obstruction.* First operation Jan. 6, 1913. Pylorotomy for malignant growth and of small lesion situated at pyloric outlet and involving the first part of the duodenum. Removal necessitated slicing off the anterior surface of the pancreas. The bleeding surface of the pancreas was lapped over with chromic catgut. Being fearful that the terminal part of the common duct might be occluded by contraction in the pancreas, cholecystotomy was performed and small rubber drainage tube fastened in place. Posterior gastroenterostomy.

*Subsequent history:* Patient made good recovery and gained rapidly in weight, the entire biliary output however came to first through the rubber drainage tube and when this was removed at the end of the second week from the biliary fistula which became persistent. After several months the condition becoming unbearable the patient requested that an effort be made to relieve him of his fistula.

*Second operation:* Aug. 5, 1913, seven months after first operation. Abdomen opened through scar of first operation, which was modified into Bevan incision. The anus followed to its origin which now seemed to be almost

directly out of the pancreatic substance at the upper border of the head of the gland. All efforts to force a probe through the terminal part of the duct were unsuccessful, and it was deemed best to attempt to reconstruct the necessary part of common duct after the method of Sullivan. The common duct was cut squarely across where it impinged on the fistulous opening. With its division there was an almost visible retraction of the proximal portion of the duct. It was found that at least two and half to three inches of artificial duct could have to be constructed. It seemed more feasible and practical to bring up the jejunum in front of the transverse colon and attach the stump of the common duct to it. This was done by fastening small caliber soft rubber tube into the duct by linen suture, marking the distal end of tube through small opening in the wall of the jejunum and infolding the tube and as much of the duct as possible (about two inches (about one half inch). The lateral surfaces of jejunum were then abraded and tucked to the adjacent surfaces of liver and pancreas by supporting sutures.

*Subsequent history:* Uneventful convalescence discharged from hospital in third week. Remained perfectly well until some time in January, 1914, six months after the last operation, when, without any preliminary symptoms, he had sudden very profuse hematemesis. His home physician reports that for two or three weeks following this he was somewhat jaundiced. This rapidly cleared up, and he is in excellent health at the present time (March, 1914).

Although requested to search his stools for the rubber tube, he has not been faithful in this regard and it is questionable whether it is still in situ. It is probable that the hematemesis was of purely gastric origin and not due to trauma from dislodgment of tube as there is no marked evidence of tarry stools.

## A NEW METHOD OF CIRCUMCISION

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THE prepuce is slit dorsally between two artery clamps. By passing a fine needle threaded with silk, through the skin and around the superficial vessels they may be tightly ligated near the line of incision (Fig. 1).

The ventral margin of prepuce is grasped by a clamp. At intervals of about three sixteenths of an inch, number nine mulhners needles threaded

are tied. However if there should be a bleeding point, an additional suture is placed.

This method of circumcision has the following advantages:

The line of incision in skin and mucosa is accurately marked off and held in place by the needles, preventing unevenness and loss of bearing.

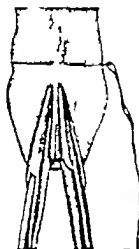


Fig. 1

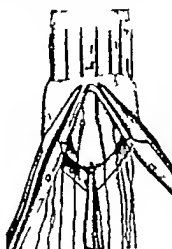


Fig. 2

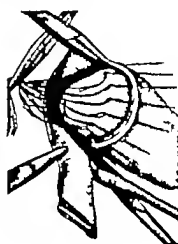


Fig. 3

with fine black silk are placed through mucosa and skin in a line around the penis about one fourth inch from the corona of glans penis (Fig. 2).

The redundant prepuce is removed by cutting with scissors around the line marked by the needles (Fig. 3).

Each suture is then drawn through and tied. Since all incised tissues are included in the suture, hemorrhage should be controlled when sutures

- Complete hemostasis
- Prevention of retraction of subcutaneous tissues
- Prevention of dead space and subsequent hematoma
- Prevention of exposure of subcutaneous tissue
- No infection
- Less traumatism
- Less pain and proppium following operation

## THE FURTHER DEVELOPMENT OF AN APPARATUS FOR THE TRANSFUSION OF BLOOD

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ABOUT one year ago the authors of the present communication began experiment to develop a method of transfusion which should be sufficiently simple and reliable to commend itself to the general practitioner, thereby enlarging the field of usefulness of this operation.

Since our earlier work on this subject<sup>1</sup> was submitted for publication we have been able to eliminate some disadvantages of the method at that time evolved, and the present development of our method and apparatus is, we believe, sufficiently improved from the practical standpoint to warrant the publication of a detailed account of the procedure with a description of the apparatus.

In order that the reader who is not familiar with the results of our experimental work may at once understand the influences which have determined the development of this method of transfusion it will be pertinent here to summarize briefly the more important factors which have led to our adoption of the present method and apparatus.

It is apparent to any one who has given it consideration that a large field of usefulness would belong to the operation of blood transfusion if it could be performed safely, quickly, and easily by any one performing ordinary surgical skill and if possible without special assistance. The one serious obstacle in carrying out a simple method of transfusing blood is the element of coagulation. If this obstacle is not safely and speedily overcome all difficulties are solved.

The theoretical factor which has appeared to us most definitely to explain the production of unusual coagulencies in blood transfused through the agency of an intermediate receptacle are:

The intimate contact of the blood with the wounded tissue and more particularly from suckling of the donor blood vessel.

The intimate contact of the blood with the elements of the blood itself, and by the time the blood is used these elements which in the process of time.

When you hit guard against the first of these tendencies, you get rid of the donor

vein with a cannula which by a jet of salt solution immediately washes clear of any contaminating tissue juices which may be carried into it by the act of removing the obturator. This cannula serves as a protective sheath through which to introduce a pipette directly into the blood stream of the donor without contact with the wounded wall of the blood vessel. To avoid abrasion of the intima of the donor vein by the tip of the pipette while drawing the blood, we have made this tip short and blunt and with its opening in the direction of the blood-current.

We have met the second contingency by having the tip of the pipette of as large caliber and as short a length as practicable and by expelling it equally as rapidly and as evenly as possible also by having an intact paraffin lining throughout the instrument. This provides a non-rough metal wall which reduces the friction in the carrying vessel to a minimum. We have also limited the speed and the force with which the blood can be drawn into and expelled from the pipette by employing a method of mouth aspiration by the operator. It is important to state in this connection that we have tried various mechanical means of withdrawing and injecting the blood, such as a Politzer bag, piston plunger syringes, etc., and that mouth aspiration is to be preferred to any of these methods. By means of a good metal plunger syringe of 20 ccm capacity it is easy to effect a pressure or suction of 100 to 400 mm Hg. and with such a forcible action it is difficult to judge the degree of effort which is necessary to keep the pressure within what we believe to be the limit of safety. The use of a vacuum and pressure gauge would of course show the difficulty but it would also unnecessarily complicate the apparatus.

The accidental factors which we formerly found liable to lead to hindrance in effecting a prompt transfer of blood have been due to difficulty and delay in obtaining an equivalent opening to the recipient in for the satisfactory discharge of the blood from the pipette. There is often no prominent or large sized vein which is readily available for use in the recipient and this leads to a delay in effecting a satisfactory entrance of the blood. It is therefore most desirable that such difficulties should be met by

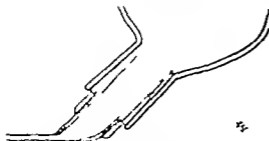


Fig. 2. Sectional view of lower part of pipette. Spec. Section. T.P. (cylindrical portion) of 4-h gold seamless drawing tubing 7 mm (67 in) long; ext. diam. 3 mm (1.00 in) int. diam. 1 mm (.080 in) soldered at the (small) portion of the tip at an angle of 45°. Tip (flared portion) of cone where interior tapered from 3 mm (0.080 in) to 30 mm (1.40 in) flanged externally 1/2 (upper extremity) to fit coupling. Coupling of brass, nickel plated, made from section of 5/32 (to 6/5 in) hexagon rod, drilled and threaded 1/2 to bushing and flanged 1/2 form on extension. The tip. Flange of same material as coupling, tapered internally from 30 mm (1.40 in) to 75 mm (.90 in) ext. diam. 1/2 mm (.040 in), threaded 1/2 low extremity to fit coupling. Cylinder blown from Jena glass tubing 54 mm (2.13 in) ext. diam. Neck of cylinder 5.4 mm (.45 in) long; int. diameter tapered from 5.26 mm (.207 in) to 6.6 mm (.26 in). Side of neck with long 11 of cylinder is 1/2 (about) 1/2 (about) by wrapping around the metal bushing part of shank tube 25 mm (1 in) side and about 1/2 mm (.17 in) thick.

The flanged union permits rotary adjustment of glass on the tip as it is moved up and down in the drawing.

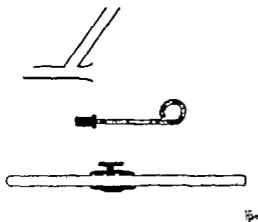


Fig. 3. Drawing of detail of 4-h gold seamless tubing 80 mm (3.15 in) ext. diameter and 55 mm (2.17 in) int. diameter. Canals are 5 mm (0.50 in) long, beveled at distal end and flared at proximal end. Lateral arm 30 mm (1.18 in) long joining canals at angle of 75° from proximal end. Fig. 4. 4-h gold seamless tubing to fit proximal end of cannula, slightly wire or of glass rod 5 to 30 mm (.20 in) diameter.

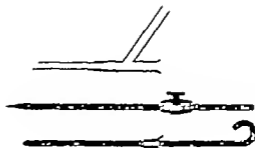


Fig. 4. Pipette with air filter containing sterile cotton and aspirating tube. Proximal part is of 4-h or 4-h gold seamless tubing same diameter as donor cannula and of similar construction. Into the distal end of this is soldered a platinum wire mesh cannula of number alloy back wire vary in size and length according to requirement. The max. found most useful is 5 mm (.39 in) long, 1.00 mm (.040 in) ext. diameter and .75 mm (.030 in) int. diameter. Cannulas of smaller diameter may be used for smaller cases and for penetrating the skin. The obstructions are made of 4-h gold wire of diameter 1/2 of the platinum cannula and of convenient length for branching. The stop on the aspirator is made to fit into the flared end of the cannula. Trocars are made the same as obstructions but with trocar points.



Fig. 5. Pipette with air filter containing sterile cotton and aspirating tube.

overcome before the actual transfer of blood is begun. The method which we have developed provides such a preparation by the means to be described, and we have found that this preparation obviates all the accidental difficulties which we had formerly encountered.



Fig. 5. Irrigating apparatus: compressible copper vessel, heavily tinned inside and outside, of three liters capacity with outlet made from black tin. Outlet has a larger tubulation above for insertion of glass gauge tube and thermometer and smaller tubulation below for trichment of rubber tubing. An electric heating plate serves as support and is attached by an arm and set screws to an iron rod, which is fastened into cast iron foot piece. A sliding sleeve of celluloid can be moved to any position on the glass gauge and is graduated in centimeters to measure the discharge of fluid from the vessel.

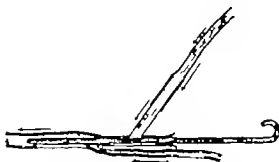


Fig. 6. Recipient cannula with obturator in situ.

The changes which we have made since our earlier report are as follows:

1. A means of penetrating the donor's blood vessel so that the paraffin-lined tip of the pipette may be introduced beyond the point of puncture without contact with the wounded wall of the vessel.
2. The employment of cannulas with openings in the direction of the long axis of the blood-vessels. This allows a more effectual withdrawal and delivery of blood and also minimizes the tendency of the vessel wall to collapse against the opening of the cannula while aspirating the blood from the donor's vessel.
3. The use of cannulas for the recipient of smaller caliber and of various sizes, so that smaller veins may be utilized in the recipient than was formerly possible.
4. A method of inserting the cannulas so that both donor's and recipient's vessels are tapped.

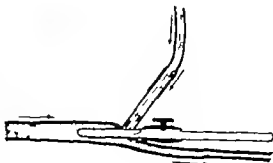


Fig. 7. Donor cannula with obturator in situ.



Fig. 2. Obturator removed from donor's cannula and pipette about to be introduced into donor vein.



Fig. 3. Obturator removed from recipient's cannula and pipette full of blood at the moment of introduction.

and in readiness before the transfusion is started. Thus not only assures a successful transfer of blood through the certainty of effecting a prompt entrance into both vessels, but also allows more time for the actual withdrawal and delivery of the blood and makes haste unnecessary.

5. The employment of a system of tubing for supplying hot normal salt solution to the canal of the donor's and recipient cannulas by means of a lateral inlet provided in the cannula for this purpose. By this arrangement the cannulas are instantly and automatically filled with salt solution during the brief interval required for the exchange of trocars, of turotors, or the tip of the pipette. This convenience furthermore provides a convenient means of giving the donor a saline infusion at the conclusion of the operation without additional preparation.

6. A modification of the pipette cannulas so that the tips only are made of gold and silver and these are made to join by threaded couplings to the metal bushings. The bushings are of nickel, and are wrapped with asbestos tape

and seated in the necks of the cylinders. Any number of cylinders may thus be prepared and kept ready coated with paraffin. When required for use the cannula tips are screwed on and a second paraffin coating is applied to the lower portion of the pipette. The details of this construction are shown in Fig. 1.

7. A method of coating the cylinder which is a much quicker and more certain to produce a satisfactory coating of paraffin than the method formerly described.

The changes here noted have come as the result of further clinical trial and of a later series of experiments on animals which there is not space here to detail. The aim of this paper is simply to describe the method so that others may test its usefulness.

#### METHOD OF OPERATION

**Instruments.** Knife, scissors, serrated forceps, mouse-tooth forceps, several mosquito clamps, donor's annula with obturator and plug (Fig. 2), recipient cannula of appropriate size (or two sizes may be prepared in readiness) with

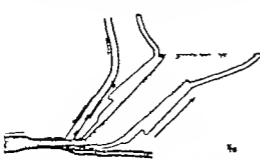


Fig. 4.

Blood being delivered through recipient

trocars and obturators (Fig. 3) needles and sili, for suturing skin hypodermic syringe and needles for local anesthesia.

**Apparatus.** One or more pipettes coated with paraffin under sterile precautions and provided with cotton air filters and aspirating tubes, as shown in Fig. 4. An irrigating apparatus for two liters of salt solution with a system of rubber tubing having a double distribution by means of a Y connection and separate stop cocks for donor's and recipient's cannulas, as shown in Fig. 5<sup>1</sup> or a separate supply of salt solution may be used for donor and for recipient if in separate rooms. An ordinary two-quart rubber douche bag may be sterilized and used for this purpose. The salt solution should be prepared as for any intra venous saline infusion and the source of supply should be at a height of about four feet from the outlet. A pneumatic cuff similar to that of a blood-pressure apparatus but about half as wide with an inflating pump, is useful for constricting the donor's arm or a piece of heavy rubber tubing with a large clamp may be used for this purpose.

**Operation.** The donor's and recipient's vessels are selected for their size and prominence avoiding the close proximity of a skin and the field of operation is painted with tincture of iodine and then washed off with alcohol. The veins at the bend of the elbow are usually the most serviceable. If the recipient is a young child the external jugular vein is usually the most satisfactory vessel to select, and this may be entered by the smallest size cannula and trocar without skin incision, as described by Wollstein and Morgan.

Local anesthesia for the exposure of the veins in recipient and donor is produced in the usual way with a two per cent novocaine solution and about 1 cc to three cc of the vein is exposed to view. The vessels should be denuded of their fascial sheath to facilitate penetration.

The recipient's and donor's cannulas are now connected to their respective ends of the irrigation apparatus by fine rubber connecting tubes and salt solution is allowed to flow through the cannulas to expel all air. The recipient's trocar and the donor's obturator are then inserted in their respective cannulas, the recipient's obtura-

tor is placed in readiness for use, and all stop-cocks are opened. The recipient's vein is first entered with the recipient's trocar and cannula in the direction of the current and the trocar withdrawn the obturator is then inserted (Fig. 6) and a pad of moist gauze placed over the field of operation. It is important to enter the vein at a point well away from the center of the exposed portion, so that the position and direction of the cannula when inside the vein may be seen and controlled.

The donor's arm is then constricted and the operator enters the donor's vein through a small incision with the donor's obturator and cannula against the direction of the blood current (Fig. 7). The mouthpiece of the aspirating tube is next grasped in the teeth of the operator and the pipette is allowed to hang thus for a moment while the donor's obturator is withdrawn, using both hands for this purpose. With the left hand still steadying the cannula in the vein, the right hand grasps the pipette and introduces its tip (Fig. 8) against the outpouring stream of salt solution, through the donor's cannula into the blood stream of the donor. The aspiration of blood (Fig. 9) is begun immediately and suction should be strong enough to get about the maximum flow without undue collapse of the vein-wall against the cannula. A speed of withdrawal greater than 100 cc. per minute should not be attempted. It is well here to mention that it is a wise precaution to treat the donor's vein gently in all manipulations and when making the incision to avoid wounding its opposite wall. A bystander may take the time from the beginning of the blood flow so that there may be some guide to the speed of withdrawal and delivery.

Two hundred cc. of blood can be obtained from a good donor in one and one half to four minutes, and this amount may be delivered through the large and medium sized cannulas in from two to four minutes making a total of four to eight minutes. We have considered twelve to fifteen minutes the limit of safety and even with ten minutes as a limit there is an ample margin of time, so that there is no need for haste.

When the amount required is obtained (100 cc. or less) the pipette is withdrawn from the donor's cannula and the obturator inserted the tip of the pipette being stoppedper as soon as withdrawn by a gloved finger of the operator.

The insertion of the donor's obturator is most conveniently done by an assistant, but it may nevertheless be done by the left hand of the operator. It is important to stop suction before with-

<sup>1</sup>Any irrigating apparatus which works by hydrostatic pressure and which can be sterilized, is superior to any of the conventional devices in the literature. The authors have however devised an apparatus here shown to meet their special requirements and will be bound to modify for any purpose here only one or two variations are desired. The descriptive features are the heating coils and the gauze which latter also permits the insertion of the trocars for taking samples from venous or arterial blood. The whole apparatus is constructed of clear glass and is graduated at every level of the fluid.

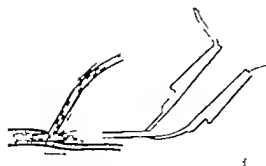


Fig. 8. Obturator removed from donor cannula and pipette about to be introduced into donor vein.

and in readiness before the transfusion is started. This not only assures successful transfer of blood through the certainty of effecting prompt entrance into both vessels, but also allows more time for the actual withdrawal and delivery of the blood and makes haste unnecessary.

5. The employment of a system of tubing for supplying hot normal salt solution to the canals of the donor's and recipient cannulas by means of a lateral inlet provided in the cannulas for this purpose. By this arrangement the cannulas are instantly and automatically filled with salt solution during the brief interval required for the exchange of trocars, obturators, or the tip of the pipette. This contrivance furthermore provides a convenient means of giving the donor a saline infusion at the conclusion of the operation without additional preparation.

6. A modification of the pipette cannulas so that the tips only are made of gold and silver and these are made to join by threaded couplings to the metal bushings. The bushings are of nickel, and are wrapped with abestos tape

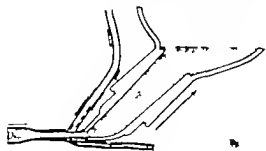


Fig. 9. Aspiration of blood from donor vein.



Fig. 10. Obturator removed from recipient cannula and pipette full of blood at the moment of introduction.

and sealed in the necks of the cylinders. Any number of cylinders may thus be prepared and kept ready coated with paraffin. When required for use the cannula tips are screwed on, and a second paraffin coating is applied to the lower portion of the pipette. The details of this construction are shown in Fig. 11.

7. A method of coating the cylinders which is easier, quicker and more certain to produce satisfactory coating of paraffin than the method formerly described.

The changes above noted have come as the result of further clinical trial and of later series of experiments on animals which there is not space here to detail. The aim of this paper is simply to describe the method so that others may test its usefulness.

#### METHOD OF OPERATION

*Instruments.* Knife, scissors, serrated forceps, mouse tooth forceps, several mosquito clamps, donor's cannula with obturator and plug (Fig. 3), recipient cannula of appropriate size (or two sizes may be prepared in readiness) with

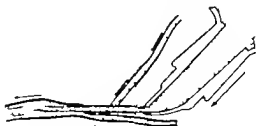


Fig. 11. Blood being delivered through recipient's cannula.

trocars and obturators (Fig. 3) needles and silk for suturing skin hypodermic syringe and needles for local anesthesia.

**Apparatus.** One or more pipettes coated with paraffin under sterile precautions and provided with cotton air filters and aspirating tubes, as shown in Fig. 4. An irrigating apparatus for two liters of salt solution with a system of rubber tubing having a double distribution by means of a Y connection and separate stop-cocks for donors and recipients cannulas, as shown in Fig. 5<sup>1</sup> or a separate supply of salt solution may be used for donor and for recipient if in separate rooms. An ordinary two quart rubber douche bag may be sterilized and used for this purpose. The salt solution should be prepared as for any intravenous saline infusion and the source of supply should be at a height of about four feet from the outlet. A pneumatic cuff similar to that of a blood pressure apparatus but about half as wide, with an inflating pump is useful for constricting the donor's arm or a piece of heavy rubber tubing with a large clamp may be used for this purpose.

**Operation.** The donor's and recipient's veins are selected for their size and prominence a cutting the close proximity of a valve and the field of operation is painted with tincture of iodine and then washed off with alcohol. The veins at the bend of the elbow are usually the most serviceable. If the recipient is a young child the external jugular vein is usually the most satisfactory vessel to select, and this may be entered by the smallest size cannula and trocar without skin incision, as described by Wolfstein and Morgan.

Local anesthesia for the exposure of the veins in recipient and donor is produced in the usual way with a two per cent novocaine solution and about two to three cm. of the vein is exposed to view. The vessels should be denuded of their fascial sheath to facilitate penetration.

The recipient's and donor's cannulas are now connected to their respective ends of the irrigating apparatus by fine rubber connecting tubes and salt solution is allowed to flow through the cannulas to expel all air. The recipient's trocar and the donor's obturator are then inserted in their respective cannulas, the recipient's obtura-

tor is placed in readiness for use, and all stop-cocks are opened. The recipient's vein is first entered with the recipient's trocar and cannula in the direction of the current and the trocar withdrawn the obturator is then inserted (Fig. 6) and a pad of moist gauze placed over the field of operation. It is important to enter the vein at a point well away from the center of its exposed portion so that the position and direction of the cannula when inside the vein may be seen and controlled.

The donor's arm is then constricted and the operator enters the donor's vein through a small incision with the donor's obturator and cannula against the direction of the blood current (Fig. 7). The mouthpiece of the aspirating tube is next grasped in the teeth of the operator and the pipette is allowed to hang thus for a moment while the donor's obturator is withdrawn, using both hands for this purpose. With the left hand still tending the cannula in the vein, the right hand grasps the pipette and introduces its tip (Fig. 8) against the outpouring stream of salt solution, through the donor's cannula into the blood stream of the donor. The separation of blood (Fig. 9) is begun immediately and suction should be strong enough to get about the maximum flow without undue collapse of the vein wall against the cannula. A speed of withdrawal greater than 100 ccm. per minute should not be attempted. It is well here to mention that it is wise precaution to treat the donor's vein gently in all manipulations and when making the incision to avoid wounding its opposite wall. A bystander may take the time from the beginning of the blood flow so that there may be some guide to the speed of withdrawal and delivery.

Two hundred ccm. of blood can be obtained from a good donor in one and one-half to four minutes, and this amount may be delivered through the large and medium sized cannulas in from two to four minutes, making a total of four to eight minutes. We have considered twelve to fifteen ccm. as the limit of safety and even with ten minutes as a limit there is an ample margin of time, so that there is no need for haste.

When the amount required is obtained (200 ccm. or less) the pipette is withdrawn from the donor's cannula and the obturator inserted, the tip of the pipette being stoppered as soon as withdrawn by the gloved finger of the operator.

The insertion of the donor's obturator is most conveniently done by an assistant but it may nevertheless be done by the left hand of the operator. It is important to stop suction before with-

<sup>1</sup> Any variation in pressure which works by hydrostatic pressure and which can be stored in all manner of shape of the container shown in the illustration. The authors have never devised the apparatus herein shown to meet their special requirements and it is found that any pressure whose action is not uniform is dangerous. The distinctive features are the leveling plate and lower passage which also permits the insertion of thermometer for taking temperature readings at the point of outflow. A side bag underneath the pump graduated in cubic centimeters and 1 mm. scale to measure the volume of discharge at any level of the fluid.

drawal of the pipette so that no air bubbles may be drawn through the blood at the moment of removal from the vein.

The pipette containing the blood is now carried to the recipient, the obturator of the recipient's cannula is withdrawn, and the tip of the pipette is inserted against the outflowing stream of salt solution into the recipient's cannula. Fig. 1 shows the outflowing stream of blood, released by the removal of the operator's finger from the tip of the pipette just at the moment of introduction into the recipient's cannula. Fig. 11 shows the tip of the pipette within the recipient's cannula while the blood is being delivered. The last 1 or 15 ccm. of blood are not discharged from the pipette in order to avoid risk of injecting air. When this point is reached, the pipette is withdrawn from the recipient's cannula and the obturator is replaced.

If more blood is needed, another transfusion may be done precisely the same way using another pipette or an assistant may collect a second pipetteful of blood from the donor immediately following the withdrawal of the first pipette. This rapid sequence of withdrawing blood from the donor is, of course, more expeditious, and is advisable if more than 400 ccm. (two pipettefuls) of blood are required. Where the interrupted method is followed, care should be taken to remove all constriction and to allow a free circulation of blood through the donor's vein during the intervals when the blood is not being withdrawn.

Although the trocar method of entering the recipient's vein has been described and is the one illustrated, it is equally satisfactory to incise the vein with a small knife or scissors as in the case of the donor and to introduce the cannula with tapered obturator through such an incision. As a matter of experience this method has been found admirable where the veins are small or the situation cramped, because either of these contingencies make it difficult to enter the lumen of the cannula by the direct introduction of a sharp trocar.

When the transfer of blood is completed the recipient's cannula is removed and pressure applied with a compress for a few minutes. Pressure and suturing of the skin will usually suffice to stop oozing from the vein. If desirable, the donor may now be given a saline infusion to replace his lost blood, simply substituting a short plug in the donor's cannula for the obturator. This stops the outlet of the cannula but does not shut off the passage of the salt solution through its lateral arm into the vein. Hemor-

rhage from the donor's vein after the cannula is withdrawn can sometimes be stopped by pressure but usually the puncture should be tied off laterally with fine catgut or suture. During the course of the operation neither the donor nor the recipient receives more than an inconsiderable amount of salt solution, unless more is desired. It may easily be seen, however, that with this arrangement any amount of salt solution can be immediately directed into the circulation of donor or recipient as required.

*Preparation of the pipettes.* The preparation of the pipettes and the method of lining them with paraffin remains to be described. The threaded bushings of the cylinders are first wrapped with thin asbestos tape and securely sealed in the cylinders. The air filter tubes and the cylinders are then sterilized by dry heat in an autoclave or ordinary oven and the rubber separating tubes with mouthpieces and perforated rubber stoppers are sterilized by boiling. When sterilized each cylinder is connected with an air filter by means of a perforated rubber stopper and an aspirating tube with mouthpiece is attached. The cylinders are then ready for coating. The rubber stoppers and aspirating tubes should be thoroughly dry before being connected with the cylinders.

The process of coating the pipettes must be conducted with aseptic precautions. The coating is best done from a cylindrical vessel, about three and one-half inches in diameter and seven or eight inches high filled to within an inch of the top with the sterile paraffin mixture. The mixture which we have used is Grubler's filtered paraffin, m.p. 60-66° C. 56 part by weight.

Pure white petrolatum, 44 parts by weight.

This mixture can be sterilized by heating to 120° C. for an hour. We have found that a convenient vessel for melting and holding the paraffin is an electric warmer for a ten ounce nursing-bottle, with heating coil immersed directly in the paraffin.

For the first coating the paraffin is heated to from 77 to 80° C. the mouth of the cylinder is then immersed beneath the surface and the paraffin sucked up into the cylinder to within about 1 cm. of the rubber stopper. The paraffin is maintained at this level until its heat has spread to the cylinder which is shown by the

The temperature here recommended 77° to 80° C. corresponds to our earlier observation of the optimum temperature for the first coating. By the former method the cylinders were coated by immersion in a large bath of the paraffin mixture and the temperature then raised to 100° C. By the present method the temperature of the bath may be raised about 10° C. higher to allow for the cooling which takes place when the paraffin runs in the cylinder.

film over the glass becoming transparent. As soon as this occurs the paraffin is allowed to flow out and the cylinder is placed aside to cool.

The pipette tips and couplings may be sterilized by boiling or by dry heat. If boiled a short time before coating they should be freed from moisture before being attached to the cylinders. This can easily be done by drying over an alcohol flame. The coated cylinders may be wrapped in sterile towels and kept in this way until needed. The pipette tips may be attached and a second paraffin coating applied at once. The completely coated pipettes being then wrapped in sterile coverings ready for immediate use.

The second coating with the tip attached to the cylinder is done at 60-61° C. by dipping the tip of the pipette beneath the surface of the melted paraffin and aspirating enough paraffin to reach about two cm. above the neck of the cylinder and immediately expelling it again. When all the excess of paraffin which has been taken into the pipette is blown out in this manner bubbles of air will be seen to escape from the submerged tip of the pipette. The pipette is then raised out of the paraffin and its tip is tilted upward while air is still being blown through it. This latter precaution is to prevent a narrowing of the lumen of the tip by delayed congealing of the last few drops of excess paraffin. The lumen of the tip can easily be inspected by transmitted light if it has not a good clear opening. It should again be immersed in the paraffin and the operation repeated until satisfactory.

A detailed specification of the construction of our pipette and cannulas is given under Figs. 1, 2 and 3, and all of these instruments can be made from the drawings by competent workmen. The gold and silver pipette tips and the gold and platinum cannulas we have had made from seamless drawn tubing by a manufacturing jeweler. The bushings and couplings have been turned out on a lathe by a machinist, and the cylinders have been blown and graduated by a glass-blower. Although we have not at present arranged for the manufacture and distribution of these instruments, we expect to do so if the demand should warrant it.

In considering the means of overcoming the factors which promote the coagulation of blood transfused through an intermediate receptacle, we have in this paper purposely confined our discussion to the use of paraffin, and have avoided reference to the use of hirudin. For some time past we have been conducting experiments with hirudin which are now giving considerable promise of practical application that is to say we have in animals with repeated success transfused blood by a preliminary wetting of the interior of the apparatus here described with a very small quantity of hirudin dissolved in salt solution, dispensing altogether with the paraffin lining of the pipette, but we are not yet prepared to report on this subject.

We wish to make grateful acknowledgment to Professor K. M. Vogel for the courtesies extended to us in his laboratory.

## THE USE OF PITUITARY EXTRACT IN LABOR

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**D**URING recent years the ductless glands of the human body have been receiving a good deal of attention in the laboratory of the physiologist whose experiments have resulted in very important discoveries, and in no case have the results been more remarkable than in that of the pituitary gland. Since the year 1895 such eminent physiologists as Oliver (1), Schaffer (2) and Howell (3) have been investigating the functions of this gland, arriving at definite conclusions regarding its effect on blood-pressure, kidney secretion, etc., but it was not until the publication of a well-known paper by W. Blair Bell (4) of Liverpool in the year 1909 that its

great use in obstetrics became recognized. Since then considerable amount of literature, mainly German, has been published, relative to its efficiency or otherwise in maternity cases, and this paper is intended to add another to the surprisingly few contributions in English on the subject.

By way of introduction to our paper we think it well to refer very briefly to the anatomy and physiology of the gland. The pituitary gland lies at the base of the brain in a depression of the sphenoid bone known as the sella turcica. It consists of two lobes, an anterior derived from an upgrowth of the basilar cavity and a posterior de-

rived from a slow growth of the third ventricle these lobes are connected by an intermediate part which has the same origin as the anterior lobe. Experimental research has shown that it is the intermediate part and the posterior lobe alone which have any physiological effect on unstriated muscle and blood pressure and it is from these portions of the gland that the extract is made.

There are at least three preparations on the market at the present time known under different names: vaporole infundin, pituitol and pituitrin. Of these we have only had experience with the first named but we understand that there is no difference in effect whichever preparation is used. In each case 1 ccm. = 1 gm. of the extract was the strength used in all our cases. We never gave a smaller dose being of the opinion that 1 ccm. produced better results than  $\frac{1}{2}$  ccm. with an interval between. The drug may be injected intravenously, intramuscularly and subcutaneously the effect being somewhat different in each case. I refer hence to this as "quot" extract from a paper published by HENRY (4) of Chicago in the year 1913. In this way because of the possibility of an undigested condition contra-indicating a slight increase in blood pressure and arteriole contraction the intravenous administration is unsuited to routine use and should be reserved for emergency cases where immediate action is highly desirable such as severe post partum hemorrhage. Where a fairly rapid result is wanted, intramuscular administration is much safer. For general use subcutaneous injection should be employed since it is without the possible harmful blood pressure effect.

and is as safe so far as the skin is concerned as ordinary hypodermic medication. Since the publication of this paper we substituted subcutaneous injections for intramuscular with we think better results. The injections are usually given in the arm, but it does not matter in what part of the body they are given. An important point which might be mentioned here is that the drug is not poisonous to the mother even in large doses and is not cumulative in its effect if repeated doses are given.

In this paper we report the results of 147 cases, and for the sake of clearness we divide it into the following headings:

1. The effect on the uterus
2. The effect on the fetus
3. The indications and contra-indications
4. Its use in placental previa
5. The after result

1. *The effect on the uterus.* In the words of W. Blair Bell "pituitary extract causes powerful contractions of the pregnant, puerperal, and menstruating uterus." He also states that its effect is equally apparent on the atonic and the contracting uterus. Our own observations agree with those of most others that the contractions resulting from the drug still retain their physiological character that is to say with very few exceptions, they are rhythmical and intermittent, but not tonic. This fact cannot be too strongly emphasized, as it is the fundamental principle governing the use of pituitary extract in labor cases. The exceptions referred to are cases in which the first pain seemed to extend over an interval of several minutes, but even in these the contractions were not what might be properly termed tonic as regular slight relaxations of the uterus were always observed during the pains. These pseudo-tonic contractions (if we might call them so) invariably took place when the head was about to be delivered, so that one would be justified in regarding them as a simple exaggeration of the normal character of the pains at that time when they are practically continuous. We also observed that the interval between the pains was diminished. In our series of cases where the extract was administered during the second stage pains followed one another with an average interval of one minute and a half where one could normally expect an interval of two to four minutes. We found that the interval elapsing from the time of injection till the onset of the first labor pain varied from twenty minutes, with an average of three and a half minutes. Twin primiparae and multiparae together if the baby was not born as a result of the injection, we found that the effect of the drug lasted fifty minutes and if birth resulted, an interval of seventeen minutes elapsed. The placenta was always expelled spontaneously except in four cases where it was adherent and required manual removal, and in no case was there any incarceration. Straumann (5) noted in his cases an earlier detachment and expulsion of the placenta an observation made independently by ourselves, for we found the placenta ready for expression in eighteen minutes in primiparae and eleven minutes in multiparae in six instances—one being a primipara—it was expelled statim, without any ill effect. Although as Fischer (6) states, the effect of the injection is better the further advanced in labor the patient is at the time this does not prevent its use during the first stage. In our series, four primiparae and nine multiparae got injections during the



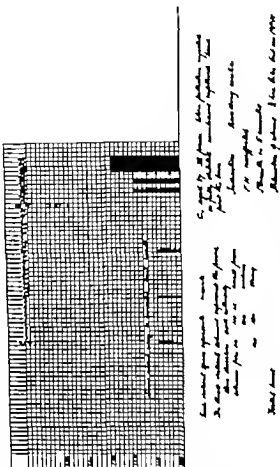
primiparae of these, five were born dead, and four were born in asphyxia, two recovering. This still leaves a foetal mortality of seven. Two of these seven had the cord tight around the neck, and one was a difficult breech delivery in a case of contracted pelvis with a conjugate of 9 cms. It is hardly fair to attribute the loss of these children to the use of pituitary extract; therefore, if they are excluded, there still remain four foetal deaths unaccounted for except as a possible result of the injection. We consider this effect on the foetus to be of the very first importance, and we state these four cases in some detail. In one the foetal heart was heard at a certain time 140 and strong; eight minutes later on listening again it had dropped to 100; forceps were applied at once but the child was delivered dead. The patient was primipara and the head was unhurt for some time after she came into labor so it is highly probable the case was a minor degree of pelvic contraction. A sudden drop similar to this was observed in the second of these cases, where the foetal heart was counted

8 1/2 minutes before delivery and the child as born spontaneously but dead. The third case was one of contracted pelvis with conjugate of 9 cms; the pains had become weak, the cervix was fully dilated, and the head was through the brim when contraction came on strong at interval of three minutes for half an hour when they again became feeble. Another injection was given, and pains occurred at interval of two minutes till the baby was born in thirty minutes. During this time there was no sign of foetal distress, and nothing unusual was noted about the foetal heart. The fourth case was one in which more gradual slowing was observed; forceps were applied as soon as possible, but too late to save the child. We consider it very controversial whether the sudden drop in the foetal heart rate in these cases was the direct result of the administration of the drug or whether other causes were operating to bring it about. Apart altogether from this, a comparison of the foetal mortality between cases treated by pituitary extract and those treated by forceps without the extract is interesting. From June 1, 1913 till February 28th of this year, 47 cases were treated in the Rotunda Hospital by pituitary extract, in the vast majority of which forceps would undoubtedly have been applied, and only four foetal deaths could not reasonably be accounted for during the same period 206 cases were treated by forceps, with a foetal mortality of fifteen. These figures would, we think, help to prove that there is at least no additional risk to

the foetus attending the use of the drug, and taking into account the absence of intra-uterine manipulation and consequent decrease in the maternal morbidity we would advocate its administration in most cases where forceps seems the only alternative.

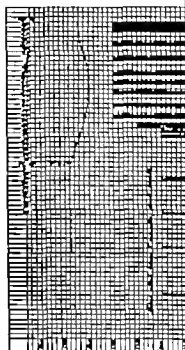
5. *The indications and contra-indications.* (1) Before labor Pituitary extract has been used by some obstetricians as a means of emptying the uterus in cases of abortion. Stern (8) and Fischer (6) report two cases each, all of which were failures. We have not employed it for this object, and so far as we can learn from a careful study of the literature the drug seems little better than useless so early in pregnancy. It has also been administered for the purpose of inducing premature labor and in this respect the results are more encouraging. Stern (6) reports three successful cases of induction for laryngeal and pulmonary tuberculosis at the eighth and ninth months, two with pituitary extract alone

and one with the assistance of a Champetier de Ribes bag. Podliot (10) reports 11 cases from Paris, three of which were for minor degrees of contracted pelvis, with two successes; two were for cases of premature rupture of the membranes before the onset of labor both of which were successful but in reference to these the writer states that the drug may only have augmented contractions which were bound to come; the remaining case was one of macerated foetus at six months which failed. Ehrlich (11) reports four cases, all of which were successful. Our own experience of inducing labor by pituitary extract alone is confined to one patient suffering from chronic nephritis who was seven months pregnant and the foetus was dead. Two ccm were successful in bringing on pains, and the birth of the foetus followed in six hours. In spite of these successes, there scarcely seems sufficient evidence to come to any definite conclusion regarding its actual value in inducing labor unaided, as up to the present, more failures have been reported than successes. Benthin (12) of Frankfurt amongst others, emphatically says that pituitary extract has no effect on the uterus when not in labor, since the uterus at this time is refractory and does not respond, whereas it does respond to the smallest dose when in labor. As an adjunct however to induction by enema or Champetier de Ribes bag it is distinctly valuable. We have given it in two such cases, one for dead foetus after version where labor pains had come on, but had gone off again in three hours. One ccm was given and contractions came on strong, expelling the foetus in five minutes. The other case



though not exactly one of induction of labor illustrates the excellence of the combined treatment. It was one of transverse presentation with the cervix half dilated, the arm prolapsed and no pains present. The arm was pushed up, internal cephalic version performed, and the head brought over the brim. A tight bander was applied, and two ccm. caused the birth of the baby in forty-five minutes.

(6) During labor. This is universally regarded as the best time for its administration, and the strong indication here is secondary uterine inertia, especially when the cervix is fully dilated and the head well through the brim. In our series, 120 patients in secondary inertia got the drug during the second stage, 87 being primiparae and 33 multiparae. The average duration of labor before injection was nineteen hours in the primiparae, and seven hours in the multiparae; and the time elapsing from injection till the birth of the child averaged twenty-two minutes and



eleven minutes respectively. Thirteen patients got the drug for primary inertia, four primiparae and nine multiparae. The duration of labor before injection was twenty hours in the primiparae and thirteen hours in the multiparae; the interval after injection till the birth of the child was, on an average two hours and forty minutes respectively. We also employed pituitary extract with excellent results in seven cases of overdistention, e. hydramnios and twins, where the uterus had become inert after the rupture of the membranes but as these were really cases of inertia, they have been included in the above. A brief reference might be made here with advantage regarding its use in minor degrees of pelvic contraction. In spite of the strong support given to this indication by almost all authorities who have used the drug, our experience in this respect has not been fortunate. We gave it in three cases all of which have been referred to above, with fatal results in all three. In one of

these, the extract might justly be exonerated from all blame, as it was a difficult breech delivery through a pelvis nine centimeters in the true conjugate but there was no extenuating circumstance in either of the other two. Whether the fetus had already been sufficiently compressed by the efforts of the uterus to drive the head through the brim, and so was unable to withstand the extra pressure resulting from the injection of the drug or whether in all such cases the use of forceps alone would be attended with better results, is, we think, still an open question. We note only one remaining indication for its employment during actual labor and that is that it should be given as a prophylactic to multipara with a history of post-partum hemorrhage or retained placenta in their previous labors. For such patients the correct time for injection is just immediately before the birth of the child. We have only had an opportunity of using it so in two cases, one being successful.

(c) After labor. Post-partum hemorrhage was the great and original reason for its employment in obstetrics. We always gave it with some preparation of ergot generally erratum in serious cases, with undoubted benefit. Though only intermittently contracting the uterus, it raises the blood pressure and counteracts shock, erratum doing the major work as far as controlling the hemorrhage is concerned, by causing tonic contraction. Its value in this respect is a matter of common knowledge and we consider it unnecessary to refer to it at greater length except to plead for its routine use in all such severe cases.

Regarding the contra-indication to pituitary extract patients suffering from chronic renal disease with raised blood pressure and chronic cardiac disease has long been considered as unfavorable for its use but some doubt has been recently thrown upon this idea. Trapl (3) who reports 77 cases, states that carditis and nephritis are not contra-indications, but advises very cautious employment of the drug. Stern (14) has induced labor with repeated injections in cases of nephritis, without any ill effects. We have successfully induced labor in one case of severe chronic nephritis, without the slightest injury to the patient, and have also used it in several cases of simple albuminuria, in no case with any bad effect. From our experience of one patient we do not advise its use in heart disease. She was a multipara admitted in labor with a cervix one-quarter dilated, the membranes ruptured, and the head fixed. Her pulse had not been strong, and after admission disappeared altogether. She had a very bad bronchitic

cough and heart trouble was not suspected at the time. One cc. was given. No pains came on, but twenty minutes later the patient suddenly collapsed with cyanosis, labored breathing, and uncountable pulse. Forceps were applied immediately and the child delivered. The patient recovered by treatment with stimulants, saline infusions, etc. but the case emphasizes the danger of the drug in heart lesions. It is hardly necessary to state that additional contra-indications to its use would be found in marked slowing of the fetal heart, threatened rupture of the uterus, and other conditions of a like nature.

4. *Its use in placenta previa.* Most writers are agreed about its important effect here, and it is found at its best in combination with treatment by version or the bag. Very few cases can be traced where it has been used unaided but Hofbauer (15) is strong advocate of its employment in cases of lateral placenta previa, the only other treatment being rupture of the membranes. As an adjunct to treatment by version or the bag, its administration is advisable if one expects to save the child, while the advantage to the mother is apparent owing to the rapidity with which birth follows version. Trapl (16) reports sixteen cases, fifteen lateral and one central, with three fetal deaths. Gill (17) had ten cases, nine central and one lateral. There were three dead children, but in all three no fetal heart was heard and primary extract was given for maternal reasons. We have employed it in five patients with placenta previa, four lateral and one marginal. Two of the five children were born dead. These cases are not numerous, but taken together we find the fetal mortality under so per cent a very encouraging result when one considers that at present the mortality stands at something between 40 per cent and 60 per cent. Although the period of labor is much shortened no instance of laceration of the cervix has yet been recorded so far as we know, nor was there any laceration or post-partum hemorrhage in our cases.

5. *Its after-results.* Such unfavorable consequences as vomiting, tinnitus, spasm of the cervix (18) and tetanus uteri have been reported, though we have not met with any of these complications. Post-partum atony of the uterus with slight hemorrhage has been observed by many. This is said to be most liable to occur when more than one hour elapses between injection and birth on account of the relaxation of the uterus which might be expected when the action of the drug has worn off. In six of our cases relaxation and slight post-partum hemorrhage were observed,

TABLE I

Indications	Number of Cases	Pain		Delivery		Result to child	
		Primipara	Multipara	Spontaneous	Forceps	Alive	Dead
Primary inertia	1						1
Secondary inertia	22	5	17	10	7		
Placenta previa				5		1	
Prepulsive inertia with history of previous post-partum hemorrhage							
Induction of premature labor							(macerated)
Alone							(dead before
Combined with other treatment							section)

There were four total failures

TABLE II

Indications	Number of injections			Average duration of labor before injection		Average interval from injection till birth of child		Average length of third stage	
	One	Two	Three	Primipara	Multipara	Primipara	Multipara	Primipara	Multipara
Primary inertia				22 hours	3 hours	1 hour	20 minutes	20 minutes	15 minutes
Secondary inertia	107			14 hours	7 hours	20 minutes	10 minutes	15 minutes	10 minutes

though in only one of these was there an interval of more than one hour between injection and birth. This was a case of a multipara whose baby was born an hour and a half after the dose was given, and she had a history of post-partum hemorrhage in former labors. In each instance the uterus hardened by treatment with ergot alone so that we do not regard them as real cases of post-partum hemorrhage.

Schmidt (9) observed after-pains in 50 per cent of cases. No other authority seems to have reported such an occurrence and certainly we have not noticed it, the uterus being invariably well involuted.

There were five morbid cases, four of which were associated with forceps, which really reduces the morbidity to one out of all the patients treated by pituitary extract alone. Considering that the morbidity in forceps operations is about 20 per cent and that the vast majority of these would otherwise have been delivered by forceps, the result so far as maternal morbidity is concerned is satisfactory.

A good deal has been written about the galactagogue action of this drug. Though only two babies required artificial feeding, we could not satisfy ourselves that it had any specific effect in promoting the supply of milk. Indeed Henney (20) has almost conclusively proved that its action in this particular is on the smooth muscle fiber of the breast, and not on the milk-glands.

Speaking generally pituitary extract is as

suitable for the private as for the hospital patient though we are far from advising the careless or uncautious use of the drug. Even in the most suitable cases, its administration involves a little anxiety because the fetal heart rate must be carefully and repeatedly noted after the injection. From our own experience we have arrived at the following conclusions regarding it:

- 1 Pituitary extract undoubtedly increases the strength of the uterine contractions.
- 2 These strengthened contractions maintain their physiological character.
- 3 The best results are obtained when given during the second stage.
- 4 Its use reduces the number of forceps operations, with consequent lessening of morbidity in these cases.
- 5 It is safe for the mother and at least as safe as forceps for the child.
- 6 It gives improved results for both mother and fetus in cases of placenta previa. If used in combination with version.
- 7 The puerperium is normal.

We append the following tables summarizing our results, also a number of diagrams illustrating the effect of pituitary extract on the uterus in labor.

We should like to acknowledge our indebtedness to the master for giving us every facility to experiment with this drug, and for many valuable suggestions, also for permission to report the results of our work.

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## THE AXILLARY SUP

B. GEORGE S. FOSTER, M.D. MANCHESTER, NEW HAMPSHIRE

Surgeon and Pathologist to the Hospital for Nervous Diseases in London

WHILE studying with Sir William Arbuthnot Lane at Guy Hospital, I noted that in all of his intestinal short-circuit work he instituted a very novel method of giving free fluid to the support of the circulatory system. As a result these cases came from the table in many instances in better clinical condition than when they were taken to the operating room.

It is with no idea of originality that I bring this matter forward in this country yet I have applied a name to the method which has heretofore been without a name. Upon returning to my own field of labor I resolved to try out this Lane procedure under the name of axillary sup, and here is the report of my observations upon fifty cases of general surgery.

The fluid used is normal saline solution which is placed in a reservoir to which is connected a Y rubber tube with glass connections. The single tube of this Y is sufficiently long to permit it to be coiled within a porcelain enamel basin filled with hot water kept at 10 degrees. The saline solution is also poured into the reservoir at this same temperature. Such an arrangement allows of a drop of from five degrees to ten degrees before reaching the hypodermoclysis needles.

The reservoir is placed at a proper elevation so that sufficient column pressure is exerted to easily force the saline into the subcutaneous tissues. The hypodermoclysis needles are always kept very sharp that they may pierce the skin with ease. They are three inches long, with the lumen large enough to permit a free stream of the fluid. Before introducing the needle the operator should be sure that no air remains in the tubes and that the saline running from the needles is of the proper

temperature. This is a very important part of the technique as there is no reason for procedure if the fluid is cool. We do not desire to take any heat from the body but rather to add to the local temperature if it is necessary.

*Preparation of the field for introduction of the needle.* After the patient is fully under the anesthetic the chest is laid bare. The arms are secured at the sides by a retentive strap attached to the wrists and running beneath the buttocks or small of the back as the case may be. Any danger of extreme pressure upon the arms and forearms upon the table edge is avoided by padding with towels. This is an important thing to look out for.

A section of the skin area just inside of the external border of the pectoralis major muscle over its most prominent part and above the mammary gland is cleansed with antiseptic soap. The axils are then wiped away and the skin perfectly dried with sterile gauze. This skin area is then painted with full-strength tincture of iodine. After this technique has been carried out in the strictest surgically clean sense we have two circular skin areas, one over each pectoral muscle, about three inches in diameter.

*Method of introduction.* While the fluid is running the needles are introduced piercing the pectoralis muscle in direction outward and slightly tilted downward until the needle point is seen to push the loose skin of the areola before it. The point is then moved about slightly to make sure it is properly situated and free.

A very important point when introducing the needles is to make sure they enter no part of the mammary gland. Should any portion of this

gland intercede the needle becomes occluded and seepage rendered imperfect, which may discourage the beginner. The technique of introducing the needles is the criterion for successful drinking during the operation.

**Trial cases.** The writer has used the axillary sup in fifty general surgical cases. These cases have not been selected but were taken in the order of admission. The series included all conditions within the abdomen, some in the chest and other parts of the body.

The amount of fluid sucked during any operation depends upon the time consumed in operating. No case has sucked less than forty ounces and some cases have taken as high as one hundred and forty ounces during an operation. The average operation upon an average sized individual will require between seventy five and ninety ounces.

At the completion of the operation the upper anterior and lateral chest wall are well rounded out, resembling the appearance of a well-padded football player, and the axilla are completely filled and rounded out.

This series of cases included patients of ages varying from twelve years to fifty years, of fat, lean or medium build.

At the completion of the operation the needles are withdrawn and the skin apertures sealed with collodion and sterile cotton. It is very important that these apertures be sealed very tightly and watched a moment to detect any leakage. The upper anterior chest and axillae are full and round. In fact, the loose subcutaneous space in the axilla is taken up and the space itself practically obliterated, and, as before stated the appearance of the chest is that of a well-padded football player.

Reviewing the fifty general surgical cases in which the axillary sup has been used it was noted that post-etheral nausea and vomiting were entirely absent. Not one of these cases herein tabled had any post-etheral vomiting. During the period that these statistics were collected many general surgical cases were not given the sup as we desired control cases to prove the efficacy of this method eliminating post-etheral vomiting. There was a marked contrast in the two conditions. The ones having the sup were not in the least ether sea-sick. On the other hand the majority of the control cases were nauseated and vomited. What an ideal way in which to secure a patient from the unpleasantness of ether gastritis and toxemia! This only goes to prove more forcibly that ether vomiting is a true toxemia amenable to dilution and elimination.

Next comes the question of post-operative

shock. When the sup is used the patient continually drinks saline, not only during the operation, but for several hours afterward. Thus in none of the cases, no matter how lengthy or serious the operative procedure, was post-operative shock met. How simple this summary as a shock, yet how important! Why should we have shock? the blood-vessels are kept well filled and the body soft tissues carefully bathed. That is just what prevents surgical shock. If for no other reason the axillary sup should be a part of supreme technique in all general surgical cases requiring other than a very few moments for operative procedure. This merely backs up Crile's firm theory as to the cause of surgical shock.

Again, in this series of cases no post-operative subcutaneous stimulation was indicated. Strychnine, digitalin, and the like were left on the shelf. The patient knew nothing of the hypodermic needle for stimulating purposes. The cardiac action was regular and normal and the whip was never used on the tired horse, so to speak.

Freedom from pain following the operation was very noticeable. Whether the sup is an active means to this end the author refrains from stating at the present time. However pain was conspicuous by its absence, and narcotics were given infrequently. The absence of gas in the intestines was remarked upon by not a few of the subjects.

The period of extreme thirst following the use of any general anesthetic has been a bugbear to humanity and a torment to the surgeon. In this series of cases there was no complaint of extreme thirst, or in fact, thirst of any marked degree. They drank continuously without being aware of this fact and the parched lips and mouth were not theirs.

Dr J B Murphy of Chicago has also done much by instituting his rectal drop method. This has truly been a great life-saver and a welcome procedure to the shocked and thirsty patient. With all due credit to the drop method, I found that none of these cases required its institution. It would seem that the sup is more congenial to the patient, as it is all accomplished during the ethereal slumber yet serves for hours afterward.

One untoward effect was noted in two of the cases, namely obstructed respirations. Both of these were young girls, thin in build and anemic. At no time was it considered a serious obstacle to the use of the axillary sup. Each of these cases took over ninety ounces.

It was noted that slight cyanosis was present and the respirations became somewhat labored and below the normal count. Withdrawal of the needles and retirement is all the needed treatment.

We have learned that careful observation as to the fullness of the a-villæ and tabulation of amount being consumed on five minute time will prevent this minor matter.

The pressure of the fluid against the chest wall must never be so great as to cause distress, but there is no danger if we fully understand the principles of the physics. A-villary sup should be a regular entity for all general surgical cases that our patients may be made the more comfortable after the operation.

#### RECAPITULATION

By the a-villary sup —

1. Post anæsthetic vomiting is eliminated

2. Surgical shock is ruled out.
3. Hypodermic or other stimulation is abelved
4. Freedom from pain and gas is noticeable
5. The dreaded after-thirst is not there
6. Regular and full cardiac action is maintained
7. The Murphy drop is not a necessity yet should not be forgotten
8. The patient return from the operating room in better clinical condition than when they entered
9. A watch should be kept for obstructed respiration however it will not occur under the trained eye of familiarity

## CORRESPONDENCE

### A WEEK OF POST-GRADUATE SURGICAL WORK IN DÜSSELDORF (GERMANY)

Düsseldorf the city which is known to us because of its remarkable municipal government and for its proximity to the world renowned Krupp gunworks and other great manufacturing plants, contains a very unique institution known as the Academy of Practical Medicine. In this institution special course in Operative Medicine is given for practitioners of surgery and gynecology. The course extends over a period of one week each year.

This course is conducted under the direction of the well known surgeon Professor Witzel, the director of the wonderful Maximal Hospital who has recently visited America.

The clinics are given by celebrated clinicians from all parts of Europe as well as by professors of the academy each individual teacher being a recognized authority on the subject which he will teach.

During the present year the course will be con-

ducted from September 25th to October 3d, inclusive. The course is free 25 marks (about \$6.00) will be paid by each surgeon attending to cover incidental expenses of conducting the course.

The committee in charge of the course consists of the following surgeons, whose names are familiar to every American surgeon: Dr. Arcey Power London, Bastianelli Rome, Dejonge Brussels, Dollinger Budapest, von Fuchsberg, Vienna, A. Hoffmann Düsseldorf, Janssen, Düsseldorf, Kirchner Berlin, Kronig, Freiburg, Lanz, Amsterdam, Pankow, Düsseldorf, de Quervain, Basel, Rosving, Copenhagen, von Schjerning, Berlin, Walther Paris and Witzel Düsseldorf.

American surgeons will be welcome. A detailed program giving the time of each clinic will be sent upon application to The Secretary Akademie für praktische Medizin Düsseldorf, Germany.

## EDITORIALS

### SURGERY, GYNECOLOGY AND OBSTETRICS

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AUGUST 1914

### OBSTETRICAL SCIENCE IN AMERICA

At the recent meeting of the American Gynecological Society the subject of the address by the president Dr J Whitridge Williams, was a review of the scientific work done in obstetrics by the members of the Society since its foundation. This covers a period of between thirty and forty years at a time when those men were in active work who established gynecology as a branch of surgery and were prominent in obstetrics. The writer of the address had examined all papers written by members of the Society upon obstetrics and found in them a lamentable absence of material of genuine scientific value. While there were many papers describing groups of cases, there were few making genuine contributions to knowledge and few which showed a study of the important problems remaining unsolved in this branch of medical science.

It may be of interest to ask what is the situation at the present day as regards scientific work by American obstetricians and gynecologists. If the writing of papers quoted by a standard review be taken as a test the following may be of interest.

The Jahresbericht über die Fortschritte auf dem Gebiete der Geburtshilfe und Gynäkologie conducted by Franz in Berlin and Vest in Halle published yearly furnishes a complete summary of the contributions to obstetrics and gynecology throughout the world. The volume which reviews the literature of 1913 contains in its index of authors more than two thousand names. If one of the most frequently used letters in the alphabet be selected and the names of authors beginning with this be classified it is found that in papers upon obstetrics and gynecology throughout the world, one in twenty was written by an American and this includes the names of well known general surgeons who do many abdominal operations for all indications. Further observation upon the literary output from the standpoint of nations shows the fecundity of German writers, and the interesting development of obstetrical literature in Italy throughout the past ten years. The English and French also contribute largely.

It may be urged against this criticism that the writing of papers is no real index of scientific work. At present the clinical aspect of medicine in America is pushed to the limit. The performance of a large number of operations may give wide personal experience but unless these cases be studied accurately reported truthfully and conclu-

sions drawn from them with good judgment results so far as science is concerned, will be disappointing. Unquestionably we in America have gone further in the clinical side than in the accurate and studious aspect of medical study.

To what can be ascribed the cause of this condition? In large part, to the economic factor which obliges a man holding a Chair as a professor to support himself and his family entirely or partially from private practice. It was once said that American medical literature is written after nine in the evening when a full day's work has first been done. It is greatly to the credit of American medicine that under these conditions the American profession has made lasting contributions of inestimable value to medical science. But the time has now come when something better may be hoped for and should be attained.

The permanent endowment of medical colleges whether independent schools of value or departments of universities, and

the payment of adequate salaries to men competent to study to write, and to teach, are imperative if American medical science is to develop and take its merited place in the scientific world. No other solution is possible, for the limits of human endurance are reached and often overstepped in the professional work of American medical men. That the American obstetrician is equal to any is shown by his operative skill, his low percentage of mortality and morbidity and his prompt acceptance of valuable methods of treatment, from any source. With the exception of his German colleagues, he unquestionably has a wider acquaintance with the obstetrical literature of the world than most others, but his circumstances are such that it has been impossible for him to maintain himself keep abreast of the evolution of obstetrical surgery and make original investigations in addition. He must be freed from financial burdens and given adequate support in his scientific career.

EDWARD P. DAVIS

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

THE 333D REGULAR MONTHLY MEETING WAS HELD MAY 15 1914, DR. FRANK W. LYNCH  
PRESIDENT OF THE SOCIETY OCCUPYING THE CHAIR

Dr. Rudolph Holmes presented A Report of Three Cesarean Sections for Unusual Indications.

DR. RUDOLPH W. HOLMES. Recently I had three cesarean sections for rather unusual indications. The first was indicated by myocarditis with excessive loss of compensation.

Mrs. K., 7 III para. The patient was under my care during the first pregnancy which was complicated with cystitis and severe inflammatory rheumatism. Labor was terminated by me in 900 by difficult forceps operation. Her convalescence was slow. She secured another attendant for her second confinement, which was spontaneous, but complicated by post partum hemorrhage and protracted puerperal fever. In this second pregnancy she had second attack of her rheumatism.

I saw her when she was between three and four months pregnant in this, her third, gestation. At the time she was very ill with an enormous cardiac dilatation with its resulting loss of compensation. She lay in the hospital for several weeks, with some slight improvement. During her stay in the hospital, in fact until after her delivery the heart was acting so abnormally that definite, positive diagnosis of the actual cause of the cardiac murmur was not made, though the leakage as considered to be due largely to the dilatation prior to this it is held that she probably had mitral or possibly aortic insufficiency. After delivery her condition improved so rapidly and really phenomenally that it was definitely determined that the lesion was mitral. During her stay in the hospital during the final period of her pregnancy and later as the time for delivery was near, she was frequently examined by Drs. Anders Frick and Eban A. Gray who supervised the cardiac therapy. In view of her previous difficulties in labor and directly due to her cardiac infirmity both Drs. Gray and Frick advised the quickest means of delivery so an abdominal section as agreed upon, with sterilizing procedure. The operation was performed March 3, a few days before term. The broad ligaments were enormously congested, the peritoneum pueris commonly shows material distention of its vessels, but in her they are quite as large as the thumb. After the section, double salpingectomy was done, burying the uterine ends. A noteworthy observation as that the moment the uterus was evacuated her breathing became quiet and on coming out of the anesthesia her dyspnea had largely disappeared. She and her baby left the hospital at the end of the third week, the baby having been saved.

The second case was for double congenital dislocation of the hips, with rachitis.

Mrs. R., age 36 was delivered three years before after 4 to 6 hours of labor by forceps. Her condition was in

attendance, but finally physician was called. From the husband's remarks one might be led to believe that the delivery was accomplished by an unscientific craniotomy (?) by the use of forceps. As result of the double dislocation she had marked tilting of the pelvis there was slight humpbacked scoliosis, and some lordosis in the same region, the latter largely determined by the posture she had to assume on account of the posterior dislocation of the hips. The vera was 8 1/4 cm. with marked diminution in the anteroposterior diameter of the whole pelvis. Mother and child returned home in two weeks.

The third case was for osteosarcoma of the right sacral ala.

Mrs. P., age 9. On admission to the hospital, April 20, I found the head in the left inguinal fossa, and, from the excessive tension of the uterus, the bladder distended and lying in the right iliac fossa. The picture of the abdominal contour was such that I surmised that the right ovary was cystic, prolapsed, and adherent in the cul de sac, which would explain the rotation of the uterus, and the dislocated head, on vaginal examination, however this was found incorrect, for large, somewhat cystic tumor was found in the right wing of the sacrum. This tumor encroached upon the cavity of the pelvis to such degree that slightly more than finger's breadth of space existed between it and the ramus of the pubes. The tumor extended from the fourth to the second sacral vertebra. The cervix as pulled high up in the left sacro iliac fossa. The bladder as catheterized, about twelve ounces of urine being withdrawn. She was twelve days from term, and as she had been having contractions for some hours, preparation was made at once for section. Her appendix as removed after the cesarean operation was completed.

This woman, as the previous (second) one, had a phenomenal convalescence—hardly any discomfort in fact, as little disturbances of pulse, temperature, and abdominal discomforts as one sees after a normal confinement.

A month after the cesarean, Dr. N. M. Percy opened the abdomen, and removed such of the tumor as was possible. It proved to be a small round-cell sarcoma.

Some two years and more ago I did a cesarean section, and two weeks later it was necessary to reenter the abdomen to remove the appendix. Since then I have been accustomed as a routine to remove the appendix prophylactically. I do not believe this procedure complicates the section

—only taking a few moments' time I believe the appendectomy should be a routine procedure where the condition of the patient warrants it.

Dr C S BACON: What anæsthesia was used?

Dr HOLMES: I use ether or gas and ether.

Dr C F PADDOCK: Mr President, the doctor is to be congratulated upon the success of his cases, and especially that the after-pains or gas-pains are lacking. Personally I have not had that experience. I have performed a number of cesarean sections, and the patients have suffered more or less from pains. I do not know how Dr Holmes' patients happened to avoid the suffering. Then, again the doctor says that ether was given in the case in question and I presume ether was given in the other cases. It would seem to me from the evidence we're getting of local anæsthesia that in the heart-case local anæsthesia would have been the anæsthesia to have used. I am not so sure but that local anæsthesia will be used more and more and eventually become the anæsthesia to be used in cases of cesarean section. During the past few weeks there have been seven or eight cases operated on in this city under local anæsthesia. I have turned one of them where the woman conversed during the operation, with absolutely no pain. The operation was conducted in a scientific manner and the recovery was prompt in this case—practically no after-pains, as I remember. She did not have the nausea we generally see and it seems to me that in that heart-case local anæsthesia would have been the thing to use.

Dr A BELCHAM KETTES: I would like to say about after-pains that there seems to be no law. I was surprised by the internist at the Cook County Hospital telling me that only in cases where morphine was given did the women have any after-pains. I have performed laparotomy and have been told that there was no after-pain whatever. I believe it is entirely an individual feature, and that there is no blame on the average careful operator at all. I wish to accentuate what Dr Paddock has said about local anæsthesia. In cardioparalysis, with a large amount of albumin, local anæsthetics do remarkably well. The patients pass through the operation practically without any shock. I had heard that Dr Webster had been having great success with local anæsthesia, so I performed a section upon a heart case under the same method. At no time did the uterus require any more care than we gave under general anæsthesia. To my surprise the patient seemed to have no discomfort afterwards, and I agree with Dr Paddock that it will become more and more popular.

Dr HOLMES (in reply): The chance of dying from ether or gas anæsthesia is very remote and as for myself I would prefer to assume such risk rather than to submit to the distress, mental and nervous, which accompany a local or nerve-blocking anæsthesia. Holding this view for myself I would be loathe to employ it on a patient of mine. We have gone through all the different methods of spinal anæsthesia, and have seen one after the other fall by the wayside as the risks outweighed just now it is nerve-blocking, but I believe this will go the way of its predecessors. I have yet to be convinced that the mental effect is good for a patient to know and to hear all that necessarily must go on in an operating room. I know one woman who is a mental wreck from having had spinal blocking.

In the third case on reopening the abdomen we found the uterus, bladder and bowel adherent to the parietal wall. She had no rise of temperature, or pulse acceleration—was remarkably free from all discomforts following her cesarean, and yet these extensive adhesions were found. Likewise clean cases (gynecological) will be operated and shortly afterwards, on reopening the abdomen extensive adhesions will be found *per centum* one will find on operation broad, dense adhesions—in post-tube cases for example and yet later on reopening the abdomen will be entirely free from adhesions. If the truth were known I believe adhesions would be found a very constant sequence of abdominal work, but, being transitory quickly are absorbed.

Dr GEORGE DE TARNOWSKI presented a paper entitled: Calcified Uterine Fibroid Compressing the Sigmoid Colon—Inaugural Thesis (See p. 169.)

#### DISCUSSION

Dr A BELCHAM KETTES: I, like Dr Turner, recently lost my calcified fibroid at the Presbyterian Hospital. It was about as hard as anything could possibly be, and struck the specimen pan with a stony sound. It was about the size of a small orange. It was pedunculated fibroid, easily removed, with very small pedicle. The specimen I considered of great value because they are spoken of so highly in the books and museums.

The patient was about 35 years old. She was on the table for fibroid with large ovarian tumor almost filling the abdomen. On opening the abdomen we had considered as numerous cystic ovaries as retroperitoneal tumor. At that time I took eighteen quarts of fluid away and reduced the size and examined the organs below I found small, orange-sized tumor entirely

calcified—I didn't saw it through because it was stolen before I could do so. The woman had no symptoms whatever. There was no change in the intestines, it which I was surprised, because of its eight. No diagnosis of the calcified fibroid was made, but diagnosis of small fibroid, which I almost considered negligible. It took weeks after I made an incision and shelled it out. It was large enough to fill an enormous basin. I think the woman was so disturbed by the large tumor that she was not aware of the other symptoms. The hardness of it made me think of the possibility of superficial calcification.

I wish to speak of one point regarding the X-ray. Dr. Potter makes the remark that calcification the size of three ordinary grains of wheat should give an X-ray picture, but he had had no actual experience in an actual fibroid case.

Dr. BERTHA VAN HOOSEN. I was very much instructed by Dr. Tarnowsky's paper because I had not realized before that these tumors were so rare. It has happened that I have seen quite a large number of partially calcified tumors—nearly a dozen—and one in particular.

I operated on a patient last fall, who had four calcified tumors, each one about the size of a billiard ball. The patient suffered tremendous vascular disturbance. Dr. Tree had been treating her for two or three months. She had tremendous edema of the legs and cardiac asthma. After failing to relieve her he asked me if I could attempt to remove it. I operated under local anesthesia and found large fibroid, about the size of coconut in the fundus. It was interstitial, and at the base of the tumor situated one on either side of the uterine artery were the large calcareous tumors. The one on the right side, as making much pressure on the artery that the latter was distended to nearly half the size of my fist. The tumors were fairly easily removed. One of the peculiar things about it, that the large interstitial fibroid, as necrotic I had never seen one before. It looked exactly as if made of ivory and on cutting it open it contained a large quantity of necrotic fluid. Another thing that is peculiar about this case was that in making the incision it had to be carried up about the umbilicus. It was impossible to dissect any further about cutting out calcareous part directly under the umbilicus. The patient had no many points covered by Dr. Tarnowsky that I was especially interested.

Dr. DE TARNOWSKY (concluding the discussion). I was very glad to hear Dr. Van Hooten say she had been fortunate enough to see twelve cases. I am sorry I did not hear of the case she operated on for I certainly would have mentioned it, as it was very interesting indeed. Dr. THUR J. DOKTOROWITZ read a paper on Dysmenorrhea Latentia. (See p. 165.)

#### DISCUSSION

Dr. ALAN C. WINTER. The reason Dr. Doerflinger became interested in the views I represent was that in the treatment of tuberculous the minimum deviations in the position of the

spleen have been found to have very great practical importance in the relation to many symptoms in the organism—gout, interstitial nephritis, chronic catarrh of the colon and a number of other minor symptoms. Poncy was the first man who applied the tubercular toxemia to clinical symptoms. Heyer holds that in all primary dysmenorrheas—dysmenorrhea which appears with the first menstruation—it is caused by a tubercular toxemia and what is meant by a tubercular toxemia is that in some remote part of the body a bronchial gland or an omental gland discharges a tubercular fluid producing partial immunity of the organism. This toxic immunity consists of a chemical substance which has not yet been isolated. This partial immunity goes on until finally the toxins become an irritant and thus are produced by the toxins proliferations of connective tissue in various parts of the body and clinical symptoms arise from this very source. One of the clinical symptoms is dysmenorrhea, chronic endometritis due to excessive connective tissue in the endometrium just the same as we have in goiters, proliferation of the connective tissue, with suppression and atrophy of the secreting substance. The tendency to day is more and more toward speaking of the psycho-nervous type—words which do not mean anything, so far as I am concerned. My own observations have led me to follow Poncy and La Rich. I have found many cases of their type and I asked a young woman, 21 years old, who has all the types and symptoms described in the article by Marcus to be here to-night. He found that in a large number of his cases there was an enteroptosis present. We all know that the type of enteroptosis in young children, 10 to 16 years old, is always connected with latent tuberculosis of the organism. In this case the young woman of 21 has been married one year. She has had dysmenorrhea since the first menstruation. She has curvature of the spine, movable kidney, sensitive retroperitoneal glands, increase in the size of the thyroid gland, and a dysmenorrhea which compelled her to seek relief. The injection of five milligrams of tuberculin produced decided reaction in the arm. She tells me her married life is not happy because she does not care for sexual intercourse. Dysmenorrhea is an affliction which interests not only the gynecologist but also the general practitioner and all those who have to do with conditions which pertain to tubercular toxemia, and that is a very wide area of territory. This condition should be thoroughly understood by the family physician before any other methods are re-

sorted to, at least, it should be determined whether the patient is affected with tuberculous toxæmia. The only proof of tuberculosis present in the organism is the tuberculin test, and it should be adopted more and more by the specialist and by the general practitioner.

DR. C. S. BACON. I think the paper of Dr. Doederlein very well represents the condition of all gynecologists in that it manifests groping for light on the subject. I don't think he will claim he has reached very satisfactory conclusions or classifications. It is certainly very discouraging that this very important subject is so much in the dark. The observations of Dr. Wiener I believe are very valuable. We have undoubtedly to consider two phases, the various local conditions, sometimes those connected with the uterus, sometimes those with the adjoining organs, enteroptosis, and so forth, and we have also to consider the influences that come perhaps by means of the blood and from other organs, the ovary, the thyroid and probably from other ductless glands. That is one set of conditions that has to be considered, and on the other hand we have to consider the central nervous system its reaction to various peripheral influences, and that certainly cannot be disregarded. If we dislike the term psychic, by technical at least we must admit that there is a good deal of difference in the nervous organisms of individuals. Some are much more sensitive to all sorts of pain than others, and we must admit that that is a very important element in this affection. For my part, I look at that first now rather than to the local condition. The illustrations that were given of women that were cured temporarily by taking actions show that the local conditions are not of importance, and if it is possible for us to institute a system of

making the body less sensitive, that could be done with great advantage. We cannot always send women away on vacations, and sometimes that would do no good, but at any rate we could help them by measures that could be adopted at home, and that is a feature that is of the most importance especially to young women. If the local conditions can be helped by simple measures we are accomplishing a great deal. While occasional operations for local treatment may be of value, still those are rather to be considered later after the other measures have absolutely failed.

DR. DOEDERLEIN (closing the discussion). I see that Dr. Wiener holds the opposite views from me in so far as he represents the maternal side of the dysmenorrhœa question, and I the nervous or neurotic side. I think we ought to follow the golden mean even in this matter. In the particular case that I had so much trouble with I gave the patient two months' treatment with the tuberculin test, but there was never a trace of temperature. I believe there must be toxæmia in many types present which is produced through long continued neuroses.

An investigator by the name of Dolche reported a long series of cases where he gave thyroid extract. I think he gave two grains three times a day, with remarkable results. As a matter of fact, I still believe in spite of Dr. Wiener's very learned views on this question that there is a host of cases in which we cannot find a maternal basis, and which we must put down as psychical or neurotic, or whatever you will. It is a hypersensitiveness of the nervous system. I see, to my satisfaction, that Dr. Bacon holds the views of most of the observers in Germany. I was over there recently and questioned a few of the doctors.

# AMERICAN COLLEGE OF SURGEONS

## HISTORY ORGANIZATION METHOD OF SELECTING FELLOWS

### HISTORICAL

The American College of Surgeons was organized at a meeting held in Washington on Monday evening, May 5, 1913. Four hundred and fifty surgeons of the continent of North America came together at the invitation of an Organization Committee which had been appointed by the Clinical Congress of Surgeons of North America at its meeting in November 1910. This committee consisted of Edward Martin of Philadelphia, Emmet Rixford of San Francisco, John B. Murphy of Chicago, Rudolph Matas of New Orleans, Albert J. Ochsner of Chicago, Charles H. Mayo of Rochester, Miss. Frederic J. Cotton of Boston, George Emerson Brewer of New York, J. M. T. Finney of Baltimore, W. W. Chapman of Montreal, George W. Crile of Cleveland and Franklin H. Martin of Chicago.

The invitations, which resulted in this large gathering of surgeons in Washington, were extended by the Organization Committee after carefully prepared campaign in which each large university city on the continent was visited by a member of the committee who met, in person, a group of selected men brought together by a committee of three in each locality which committee had been chosen by the Organization Committee to extend an invitation to the surgeons in their locality to meet the representatives of the Organization Committee. These five hundred men who were invited to the meeting in Washington, four hundred and fifty of whom responded represented all branches of surgery and surgical specialties.

### ORGANIZATION

At this meeting in Washington, called for the purpose of effecting an organization, the Committee on Organization presented a definite tentative plan, which plan included a call of the meeting, the presentation of by-laws, the presentation of resolutions, and a plan for the completion of the organization by the election of governing bodies and executive officers.

#### CALL OF THE MEETING

The men were called together by Ed and Martin, Chairman of the Organization Committee who called for the reading of the Call of the Meeting.

The Call of the Meeting was read by Franklin H. Martin, Secretary of the Committee. This call, which is herein quoted in part, summarizes the work for which, in the opinion of the committee, the American College of Surgeons should stand.

First It should formulate a minimum standard of requirements which should be possessed by any a thorized graduate in medicine who is also ed to perform, independently, surgical operations in general surgery or any of its specialties.

Second It should consider the desirability of listing the names of those men who desire to practice surgery and who come under the a thorized requirements.

Third It should seek the means of legalizing under national, colonial, state, or provincial laws, a distinct degree supplementing the medical degree which shall be conferred upon physicians possessing the requirements recognized by this law as necessary to be possessed by operating surgeons.

Fourth It should seek co-operation with the medical schools of the continent which have the right to confer the degree of M.D. under the present recognized standards, and urge these colleges to confer a supplementary degree on those of its graduates who have, in addition to their medical course, fulfilled the necessary apprenticeship in surgical hospitals, operative laboratories, and actual operative surgery.

Fifth It should authorize and popularize the use of this title by men upon whom it is conferred and its use should especially be urged in all directions of physicians in order that the laity as well as medical men may distinguish between the men who have been authorized to practice surgery and those who have not.

The founders organization was completed by the election of a chairman and a secretary and the authorization of an order of business. The meeting then proceeded to complete the organization by adopting by-laws, rules and regulations and electing governors, regents and officers.

### BY LAWS

I. NAME The name of the corporation shall be the American College of Surgeons.

II. OBJECT The object of the College shall be to elevate the standard of surgery to establish a standard of competency and of character for practitioners of surgery to provide a method of granting fellowships in the organization, and to educate the

public and the profession to understand that the practice of surgery calls for special training, and that the surgeon elected to fellowship in this College has had such training and is properly qualified to practice surgery.

**III. THE COLLEGE.** The College shall consist of all members of the corporation. Such members are to be designated as Fellows. The College shall vest the general management of the corporation in a Board of Governors. The Board of Governors shall in turn vest the details of the management in a board of trustees to be known as the Board of Regent.

The College shall hold an annual meeting on the day and at the place selected for the annual meeting of the Board of Governors.

**IV. BOARD OF GOVERNORS.** The original Board of Governors shall consist of the surgeons invited by the Organization Committee to serve as founders of the College who have qualified as Fellows. The members of this first Board of Governors shall also be known as the Founders of the American College of Surgeons.

The original Board of Governors shall be divided by lot into three classes to serve one, two and three years respectively. At the annual meeting in 1904 and at the annual meeting in each year thereafter the Fellows of the College shall elect in a manner to be determined by the Board of Regents fifty surgeons from among the Fellows of the College to membership on the Board of Governors each to serve for term of three years, thirty of these members are to be elected from list of nominations consisting of three members each, nominated by the following fifteen surgical associations and societies of North America and one each from United States Army and United States Navy.

American Surgical Association  
Surgical Section of the American Medical Association

3. Section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association

4. General Surgical Division of the Clinical Congress of Surgeons of North America

5. Division of Surgical Specialties of the Clinical Congress of Surgeons of North America

6. American Gynecological Society

7. Southern Surgical and Gynecological Association

8. Western Surgical Association

9. Section on Surgery of the Canadian Medical Association

American Association of Obstetricians and Gynecologists

11. American Orthopedic Association

12. American Association of Genito-Urinary Surgeons

13. American Laryngological Association

14. American Ophthalmological Society

15. American Otolological Society

Ten members shall be elected at large to represent surgeons of North America not affiliated with

the above societies or associations. In case of failure of any of the above named organizations to make its quota of nominations, or in case of duplication of nominees, the Board of Regents shall nominate members from among the Fellows at large for the vacancies so caused in the list of nominees. The Board of Regents shall in the same manner fill all vacancies in the current membership of the Board of Governors due to death, resignation, or other causes.

3. The Board of Governors shall at its first meeting elect from among its own membership twelve who shall be members of the Board of Regents; the group shall be divided into three classes of four members each, whose terms of office shall expire in one, two and three years respectively. As the term of service in each class expires, their successors shall be elected, each for a term of three years. Not more than three of each class shall be selected from one country. In the event of death or resignation of any member of the Board of Regents, his successor shall be elected at the next regular or special meeting of the Board of Governors, but the Board of Regents may appoint a member of the Board of Governors to serve as Regent until this election takes place.

4. The Board of Governors shall meet in executive session annually for the transaction of business, which business shall include the election of members of the Board of Regents and the election of officers as provided in Article IV, Section 3, and other routine business which may be brought before it by the corporation or the Board of Regents. Such meetings shall be called by the Secretary at the direction of the Board of Regents. Special meetings of the Board of Governors may be called by the Secretary at any other time at the request of the Board of Regents. Members of the Board of Governors shall be expected to attend other formal meetings and convocations called by the Board of Regents for the purpose of conferring fellowships and the transaction of other business.

5. Fifty members of the Board of Governors shall constitute a quorum for the transaction of business.

**V. OFFICERS.** The officers of the College shall be a President, First Vice-President, a Second Vice-President, Treasurer and a General Secretary. Such officers shall be elected by the Board of Governors from among the Fellows of the College, each for term of one year and shall serve until their successors are elected. The President, the General Secretary and the Treasurer shall upon their election to office become members of the Board of Regents.

(1) The President shall preside at all regular and special meetings of the College and of the Board of Governors and at all convocations for the conferring of fellowships.

(2) The Vice-President shall preside at all meetings of the College in the absence of the President and in the event of the death or resignation of the President shall assume the duties of that officer.

(c) The General Secretary shall keep all records of the Corporation, the Board of Governors and of the Board of Regents, shall mail the proper addresses all notices of regular and special meetings of the College, of the Board of Governors, and of the Board of Regents, and shall have a general supervision of the business affairs of the Corporation under the direction of the Board of Regents.

(d) The Treasurer shall receive all funds of the College and disburse the same on checks, signed by him and countersigned by the Secretary. He shall make a report in writing to the Board of Regents at each meeting of that Board of the moneys received and expended, and shall furnish a detailed statement of the financial condition of the College at each annual meeting of the Board of Regents. The Treasurer shall furnish a bond to the Board of Regents for the faithful performance of his trust.

(e) In the event of the death or resignation of the General Secretary or Treasurer the Board of Regents shall elect his successor from among the members of the Board of Governors to serve until the next annual meeting of the Board of Governors and until such time as his successor is elected and qualified.

VI. BOARD OF REGENTS: The Board of Regents shall consist of the President of the Corporation, the General Secretary of the Corporation, the Treasurer of the Corporation and twelve members of the Board of Governors elected as hereinafter provided.

The duties of the Board of Regents shall be those ordinarily performed by a board of trustees, namely the transaction of all detail business devolving upon the Board of Governors in carrying out the object of the organization the regulation and conserving of its property interests the creating appointing and directing of all standing committees the election of Fellows of the College the calling of all meetings of the Corporation or already provided for the arrangement of convocations or other meetings for the conferring of Fellowships the transaction of all business not otherwise provided for that may pertain to the Organization.

3. The officers of the Board of Regents shall be a Chairman and a Secretary.

(a) The Chairman of the Board of Regents shall be elected from among the members of the Board of Regents for a term of one year and shall preside at all meetings of the Board. In the event of his death or resignation, the office shall be filled by election at the next meeting of the Board.

(b) The General Secretary of the Corporation shall be the Secretary of the Board of Regents.

4. The Board of Regents shall elect the following committees: Credentials, Standardization of Fellowships, Legislation, Graduate Schools and Hospitals.

(c) Each standing committee shall consist of five members, the Chairman of which shall be a member of the Board of Regents. The other four

members may be selected from the Board of Governors or from the body of Fellows of the College.

(d) Other standing committees may be elected from time to time by the Board of Regents.

5. Eight members of the Board of Regents shall constitute quorum for the transaction of business.

6. Regular meetings of the Board of Regents shall occur once in six months on the call of the Secretary. Special meetings may be convened at any time by the Secretary or on a request to him made in writing and signed by thirty members of the Board of Governors, or eight members of the Board of Regents.

VII. FELLOWS: The Fellows of the College shall be graduates in medicine who are licensed to practice medicine in their respective states and provinces, or medical officers of the federal services, who have made an application for fellowship (such application being endorsed by three Fellows of the College one of whom shall be a member of the Board of Governors), who meet the qualification requirements that shall from time to time be established by the Board of Regents and who shall be elected to fellowship by the Board of Regents on recommendation of the Committee on Credentials, and who shall have signed the roll.

Each individual elected to Fellowship in the College shall be designated as a Fellow of the American College of Surgeons and shall be authorized and encouraged to use the letters F. A. C. S. after his name on professional cards, in professional directories, and in articles published in surgical literature.

VIII. FEES: An initial fee of twenty five dollars shall be required of each member of the College on his election to Fellowship by the Board of Regents. A fee of five dollars shall be required each year for five years. A payment of fifty dollars at entrance shall relieve the member of further payments.

IX. PUBLIC ROSTERS: The Board of Regents shall cause each year a directory containing the names and addresses of the Fellows of the American College of Surgeons arranged by states, provinces, and colonies.

X. Any member of the College may be expelled for conduct which in the opinion of the Board of Regents is derogatory to the dignity of the College or inconsistent with its purposes. Such expulsion must be voted by majority vote of the whole Board of Regents at any meeting to which meeting the member against whom charges are made shall be invited to be present, and may appear or may be represented, in a manner to be determined by the Board of Regents.

XI. These by-laws may be amended by majority vote of those present at any regular or special meeting of the Board of Governors, or at a meeting called for the purpose on request made in writing by a hundred members of the Corporation, provided that such proposed amendments are included in the call of the meeting at which such action is contemplated.

## OFFICERS

President, J M T Finney, Maryland, First  
Vice-President, W W Chipman, Quebec Second  
Vice-President, Rudolph Mates, Louisiana Treas-  
urer Albert J Ochener Illinois General Secretary  
Franklin H Martin, Illinois

## BOARD OF REGENTS

J M T Finney, Maryland Albert J Ochener  
Illinois Franklin H Martin, Illinois George E  
Brewer New York George E Armstrong Quebec  
John B Murphy Illinois Ed and Martin, Penn-  
sylvania, Frederic J Cotton, Massachusetts Her-  
bert A Bruce, Ontario, Charles F Stokes, Penn-  
sylvania, William D Haggard, Tennessee George  
W Crile, Ohio, Robert E McKeechise, British  
Columbia Charles H Mayo Minnesota Harry  
M Sherman, California

## SELECTION OF FELLOWS

It was determined by the organization to admit  
surgeons to fellowship under two groupings. First,  
the charter members, consisting of surgeons of  
distinction and ability who have been in the practice  
of medicine not less than eight years and who, in  
the opinion of the Board of Regents, should be  
entitled to fellowship without the formality of an  
examination second, those who should be required  
to submit to an examination or other test of qualifi-  
cation required by the Board of Regents. It was  
decided to limit the time of admission of the first  
group or charter members to November 9, 4  
and to postpone the admission of Fellows by exami-  
nation until the Board of Regents had formulated  
detailed plans of satisfactory nature for admission  
by this method, not earlier than November 1, 913.

## APPLICATION FOR MEMBERSHIP

The Board of Regents at its earlier meetings  
announced that it would be the spirit of the associa-  
tion to open the fellowship to all competitors in  
surgery without favor. The Board of Regents is  
anxious to have every surgeon on the continent,  
who can fulfill the membership requirements, be-  
come Fellow of the organization. The General  
Secretary is therefore instructed to send application  
blanks to any legally qualified practitioner of  
medicine on the American continent who may  
signify his desire to become member.

## METHOD OF SELECTING FELLOWS

The by-laws specifically state that the Fellows  
of the College shall be graduates in medicine who  
are legalized to practice medicine in their respective  
states or provinces and who meet the qualification  
requirements that shall from time to time be estab-  
lished by the Board of Regents.

The application blanks are uniform and each  
applicant for membership is required to file an  
application blank filled out in detail and signed.  
The blank contains the following questions:

Name Address Place and date of birth  
What school, academy, college or university did you  
attend? Date of graduation? Degree?  
What medical college or colleges did you attend?  
Date of graduation? Degree?  
In what hospitals have you been an intern, resident,  
or assistant? From \_\_\_\_\_ to \_\_\_\_\_  
I what hospitals have you been staff member and  
in what capacity?  
I what teaching capacity have you been active?  
What other appointments have you had?  
What post-graduate studies have you pursued in  
America and where?  
What post graduate studies have you pursued abroad  
and where?  
What official positions have you held?  
How many years in special practice and where?  
What department of special practice?  
What percentage of your work is surgical?  
What research or experimental work have you done?  
Of what medical societies are you a member?  
Give the names of five prominent surgeons as refer-  
ences, at least three of whom are from your own  
state.  
Give the names of books and contributions to medical  
and surgical literature of which you are the author  
with date and place of publication.  
Signed \_\_\_\_\_  
Date \_\_\_\_\_

The application papers contain a separate decla-  
ration against the practice of fee splitting. This  
is in the nature of a personal pledge, and each appli-  
cant is required to attach his signature to it and  
file it with his papers.

This declaration is prefaced by an explanatory  
preamble that reads as follows:

At the meeting in Washington, when the American  
College of Surgeons was founded, the question was asked  
whether the College would positively exclude surgeons who  
were suspected of fee splitting or paying commissions in  
any form whatsoever. The President declared that no  
one should be admitted who was suspected of being guilty  
of this pernicious practice. The declaration was re-  
ceived with universal and most enthusiastic applause.

It does not seem possible that any man who would  
otherwise be eligible can belong to the class of fee-splitters,  
but the fact that the matter is so much emphasized  
has induced the Committee on Credentials to prepare  
the following positive declaration, which will be filed in  
connection with the credentials of each Fellow.

If the College succeeds in eliminating this evil, the public  
will be enormously benefited.

Very respectfully

COMMITTEE ON CREDENTIALS

## DECLARATION

I hereby promise upon my honor as a gentleman that  
I will not, so long as I am a Fellow of the American Col-  
lege of Surgeons, practice division of fees in any form  
neither by collecting fees for others referring patients to  
me, nor by permitting them to collect any fee for me, nor  
will I make joint fees with physicians or surgeons referring  
patients to me for operations or consultations, neither will  
I in any way directly or indirectly compensate any one  
referring patients to me nor will I allow any such act or  
arrangement as a substitute for this purpose.

Signed \_\_\_\_\_

Date \_\_\_\_\_

## REFERENCE BLANK

While the by laws require that an applicant give three endorsemens, the Committee on Credentials now recommends that five names be given three of which should be from the applicant's own state. The reference blank contains the following:

- Name \_\_\_\_\_ Address \_\_\_\_\_ College and date of graduation \_\_\_\_\_
- 1 How long have you known the applicant? \_\_\_\_\_
- 2 What is his surgical standing in the profession? \_\_\_\_\_
- 3 What is his experience as a surgeon? \_\_\_\_\_
- 4 How extensively does he specialize? \_\_\_\_\_
- 5 What special training in surgery has he had? \_\_\_\_\_
- 6 What is his moral standing in his community? \_\_\_\_\_
- 7 What is his ethical standing? \_\_\_\_\_
- 8 Do you believe he will carry out in practice the spirit of the enclosed declaration? \_\_\_\_\_
- 9 Do you believe from your knowledge of the applicant, if that \_\_\_\_\_ can accept in good faith his fulfillment of the principles involved in the enclosed declaration if signed by him? \_\_\_\_\_
- Do you believe he is in every way qualified for Fellowship in the American College of Surgeons? \_\_\_\_\_
- 1 Remark \_\_\_\_\_

## COMMITTEES ON CREDENTIALS

The Board of Regents has authorized Committees on Credentials consisting of the Central Committee, which reports directly to the Board of Regents, and State and Provincial Committees, which report to the Central Committee on Credentials.

The Central Committee on Credentials holds its meeting in the office of the College where the members can have access to all papers and correspondence filed in connection with each candidate.

The State and Provincial Committees, each consisting of from five to seven members, are located in nearly every state in the United States and in four divisions of Canada.

## DUTIES OF COMMITTEES ON CREDENTIALS

The name of each applicant for fellowship together with the names of his references are sent by the Central Committee on Credentials to the State or Provincial Committee which has jurisdiction over the territory in which the candidate resides and this local committee after consideration makes its recommendations to the Central Committee.

When an applicant's papers are complete including a report from each of the references given and from the State Committee on Credentials, the Central Committee on Credentials takes up the application for final consideration and recommendation.

When the candidate has successfully passed the final scrutiny of the Central Committee on Credentials, he is recommended to the Board of Regents for election to fellowship. If on the other hand, the candidate's papers are found defective or his qualifications are considered below the standard for fellowship required by the College, the Committee on Credentials notifies the candidate to that effect.

## ACADEMIC ROBE

After careful consideration of the matter and in view of the fact that important convocations at which new Fellowships will be conferred will occur each year the Board of Regents adopted a distinct fellowship gown which in their opinion, will add dignity, uniformity and academic distinction to the formal gatherings of the College.

The gown adopted consists of a body of navy blue moiré. A scarlet velvet facing, five inches wide extends around the neck and down each side of the front. The cap is of the same material as the gown, with a scarlet tassel.

## MASS MEETING WITH REPORT OF THE BOARD OF REGENTS OF PROGRESS

A mass meeting of the Fellows of the American College of Surgeons was held at The Bellevue Stratford, Philadelphia, June 9-10. The meeting was called to order by President Finney at four o'clock. In the following address he outlined the purpose of the meeting and called upon one after another of the Regent to explain what had so far been accomplished by this organization, and what the Regents had in view for the future conduct of the College.

It was thought best by the Board of Regents to call this informal meeting in order that we could discuss in time the affairs of this College.

The Board of Regents has not forgotten the fact that we are your servant not your masters, and we reiterate an account of our few doings. We want you to know everything that is to be known about the affairs of this College. It is your right and

we are here for that purpose. It was thought that this could best be accomplished by having a few short talks about the various aspects of the College which appears, from the letters, requests and questions that have been received by the Board of Regents, are not clearly understood. It was thought that these matters could best be explained in this manner.

After these few talks we will throw the meeting open for few minutes for questions that may not be covered by speeches of the afternoon. We want in this way to get you all the information that we possess. This is not close corporation. This is your organization, formed by the surgeons of Canada and the United States for a distinct purpose. That purpose let it not be forgotten is first and foremost the good of humanity and next the uplift of the profession. A new conceive it.

those two propositions also go together there is nothing antagonistic about them.

The ideals of this organization you already know. I want to tell you that we, as an organization—as the governing body of this organization—have lived up to them to the best of our ability. If in any way we have failed, it is not because we have not tried, but it is because of circumstances over which we have not had complete control.

I will not take the time to recite these ideals. They were stated as positively and definitely as it was possible to state them at the first conference. We are endeavoring in every way we can to live up to our ideals now, and we will in the future. What do we hope to do? I am not going to take the time myself to state or recite our hopes and aspirations, as others will do that better than I.

What have we accomplished? While we are yet rather young, and have not accomplished great deal, judging from the reports coming in from all over the country by letter and by word of mouth, I believe we are accomplishing great deal. I believe it is a fact that we have already accomplished more than it was reasonable to hope could be accomplished in given time. What we hope to accomplish in the future will be stated by others.

To whom is credit due for what has already been done? I want to take this opportunity to express my personal appreciation of the work of the individual members, individually and collectively of the Board of Regents. It has never been my privilege to work with quite so diverse a body of men, men who have had so much at heart a great cause, as this particular body of men, with whom it has been great pleasure and privilege to be associated.

I want to take at this time an opportunity to say that I am perhaps more than any other Dr. Franklin Martin, is due the credit for what has been accomplished. I want to bear witness at this time—he is here and would not want me to say what I am going to say—but I feel that I owe it to you as an organization and to him as an individual, to say that I have never seen any one show greater devotion or more unselfishness of purpose or more unselfishness than he has in the work he has done for the American College of Surgeons.

We have set for ourselves great task, greater really than we appreciated when we began. How can this be accomplished? It can be accomplished in one way only. In the first place by the confidence that you as individuals, have in the ability of this organization to do the work which it has set out to do. If we are confident that it can do the work, then the work is more than half done. I want to thank you on behalf of the Board of Regents for the confidence—the extraordinary confidence—that has been shown by the Fellows of this organization in the present management. It is appreciated by all of us.

This work cannot be done without the means to do

it. We are confident that this organization can carry on its work, can accomplish the aims and objects in the minds of the founders—but we must have the means with which to carry it on.

A question that is going to be answered presently is "What are you going to do with all this money?" And that reminds me of a story. A colored man who was recently married met a friend on the street who said, "Sam, how are you getting on?" Sam said, "Getting on bad. Why what is the matter?" I am worried about my wife all the time wasting money yesterday quarter to-day fifty cents, and to-morrow she will want a dollar. "Well, Sam, what are you going to do about it?" "Well, she hasn't got any yet."

"We are not worried about what we are going to do with the money, what we are interested in now is getting it. You will hear something about the plans we have in mind—and they are big ones. We will account for every cent we get, later on."

Now I am going to call on the other men, one after the other, to speak to us. I am going to call on Dr. Oschner and ask him to tell us about the money and the prodigious work of the Committee, which has had much to do with the selection and determining as to the qualifications of those who are to be members of this organization.

The report of the finances of the College was read by Dr. Oschner.

#### CREDENTIALS COMMITTEE REPORT

Dr. Oschner also outlined the work of the Committee on Credentials.

For the work of the Credentials Committee I will say that no member of the Committee had any idea of the extent of the work that would be necessary to investigate the credentials of the proposed members. The Committee is composed of most of the leading men in the surgical profession in the city of Chicago, each being professor in one of the largest colleges, and each one at the head of a department of surgery in one of the principal hospitals. They are men whose names I am not permitted to give but they are men whom all of you know. I mention this fact because you can place yourself in their position and imagine yourself giving one evening, from seven o'clock until towards midnight, once a week throughout the entire year to the work of the Credentials Committee and these men, together with Dr. Martin, who is not on the Committee, but who was present constantly to help out the Committee, were present at fifty meetings, each lasting at least four hours a day. Taking the union labor day of eight hours they have given six full days during this year to the work of this Committee.

Now as to the character of the work. Every one of the applications passing through their hands has been scrutinized and every word of every application gone over first the application, then the report of the State Committee then the report of

all references. Then if there was anything concerning any one of these items that contained the slightest doubt, this matter was immediately discussed by the entire committee and not dropped until some conclusion had been reached. The conclusion was either that the applicant was entirely unfit, or that the references were not clear enough or that some portion of the references was so vague as to require further investigation or that there was some prejudice on the part of some member who had furnished information or that the objection was not valid and that the applicant should be passed.

Undoubtedly of the two thousand applications that have not been acted upon favorably as yet there are many that should have been acted upon favorably had it not been for the fact that one of these elements raised some doubt or question in the mind of one of the members of this Committee. Not one single name has been passed so long as there is any doubt in the mind of any member of this Committee and I will say of a man on this Committee has shown the slightest prejudice to any name. Every case was handled entirely upon its merits.

This work has required an enormous amount of correspondence and in many instances a package of answers to the inquiries as much or two high have been received which have sometimes left the Committee more thoroughly muddled than before. Many of these names undoubtedly should have gone in during this convocation but in many instances it is not possible for all of the members to decide favorably and we adhered to the rule that the decision must be unanimous; there must be no doubt left. That may account for the fact that in a number of your home towns you will find some colleagues whom you ask to be member and who has not been favorably acted upon. It may be some one who you might say is better qualified than you are or more so than some man in a neighboring town whose credentials have been satisfactorily passed upon but so long as there was any doubt in the mind of any one of the Committee the name could not be passed favorably and it was filed away for future consideration.

I want to make some suggestions to the members of the College for the purpose of facilitating this work. There are as we have stated, some thousands of names not acted upon favorably. I am sure that the credentials on their face were so defect-free that they have not even come to the hands of the Committee. The very efficient secretary of our committee examines every one of the credentials and after finding defect, once seen their correction, if possible by writing for explanations from those who have sent in vague or otherwise defective references.

Now what should you do to help clear up the other credentials and facilitate the work so that all those who are eligible can be passed upon by our committee before November.

First could you tell the necessary

amount of time to determine just what you should say regarding these applicants. These colleagues of our committee have given 5 full days of their time. Why should you not give a few hours to make sure you know something definite about a man? We send you these reference blanks and ask you to send in a report. Why should you not give a sufficient amount of time to know absolutely what to say to us about the candidate? Just give the required amount of time and if you don't know the applicant see some fellow in the College who does know him.

Secondly we ask you to be positive. Do not be indefinite. If a statement comes in indefinitely prepared some member of the Committee will say "If that man were all right in every particular this reference would be definite. We have repeatedly spoken of this in our communications but we will ask all fellow once more to be definite."

Thirdly we will ask you to leave everything personal out of the question. It does not make a bit of difference what difficulties you have had with this man or that man whose application comes to your hands, you should handle it fairly. It is of no importance so far as the writing of the letter is concerned, if he be your worst enemy but has the qualifications, the committee should not influence the answers in the slightest difference. We have found in a number of instances that we could not act favorably simply because there has been some personal animosity.

Fourthly we wish to impress upon you that the membership of State Committees cannot be made public at the present time because it would expose the members to endless annoyances by unorthodox men. And so we will ask the State Committees to apply to the Fellow and ask them to send in reports to them and they will turn report to us. When such a request is made take the time to go and see a man personally talk the thing over with him and find out where he stands then tell us just what you think about it.

Regarding the work of the State Committees for the future I would say the same thing that I have said to the Fellow with this addition. When our committee is willing to give us every week this work we think it reasonable to expect the State Committees to give us every month. Have monthly meetings look ahead, assigning this name to this man and that name to that one, and have them come and make a monthly report. I am sure you will get as much satisfaction out of it as our committee has. The more they work, the more enthusiasm they show over the work, the more they feel that it is worthwhile. This thing is our baby and naturally Dr. Martin and I do not mind being pestered with it. We have gotten these other men of the Credentials Committee to walk the floor with it with the same grace so that we hope every one of you will join in the same spirit.

To illustrate what has repeatedly happened I quote one case. We had an application from a man who was graduated from one of the greatest

universities, and from one of the best medical schools. If I had taken service in one of the biggest hospitals in the country and settled in the middle of a state, and never made much ado about it. He had an enormous practice and looked after it well. The State Committee sent back report on this man.

Unknown. If one of them had taken the time and made an appointment with that man to see some of his work, he would have sent back a statement that this man was one of the best prepared men in the entire state.

So I would ask each one of you to adopt and care for this baby at least for the time that I put it in your arms.

#### LOCATION OF PERMANENT HOME

Dr. Stokes as Chairman of the Committee on Permanent Location made the following report:

Our President has requested me as chairman of committee for the selection of location of home for the College to lay before you what progress has been made by this committee.

In order carefully and conscientiously to consider the question of the locality best suited for the siting of the home, naturally the aims and policies of the College must figure in the problem.

We have organized and the success in organization has exceeded the rosiest of expectations. The methods of organization have been severely criticized in some quarters but in every great undertaking there must be start and if as some of our critics unobtrusively say many mistakes have been made the future will take care of them.

You will hear men say that this or that man ought not to be Fellows of the College. These I have said. Give me proper and sufficient grounds and I shall spare no effort to see that he or they cease to have any further connection with this organization.

Thus far there has been no response from any one. If the membership in certain societies and associations in surgery and the specialties are drawn upon and as a result some possibly unqualified individuals were improperly honored as Fellows, as alleged, it seems to me that the onus falls upon the societies and associations in which these men were credited and not on the College.

As you are well aware the College is organized; the next problem is administration, and this to my mind is the paramount issue confronting us today. As we are planning very largely for the future, much thought and deliberation and no undue haste should be exercised in outlining our administrative policies.

What are the aims of the College? Primarily to help those in need of surgical treatment which will best be accomplished by upholding the standards of surgery, and by making the ideals and policies of the College felt in the undergraduate schools, graduate schools and hospitals, large and small. The best work is not confined to the great clinics. Excellent work is done in some of the small hospitals, others should be encouraged to raise the standard

of their work and equipment. It should be the duty of the local committees on credentials to seek out and encourage the properly qualified, remotely located surgeon by honoring him with a Fellowship, or by inviting him to qualify. Dr. Oschner has just told you of a man in a western state who was reported by the local committee as unknown but when further investigated at the suggestion of the central committee was found to be a man of exceptionally good training, was doing good work and was in every way qualified for Fellowship. This spirit should continue.

The scheme of judging of the qualifications outlined by Dr. Edward Martin in itself will be stimulus to better work if impartially and conscientiously carried out. In order that the man who has graduated from an accepted school and has completed his service in an accepted hospital may not be discriminated against during his five year period of probation, I would suggest that he be permitted to present his school and hospital credentials; and, if actual story that he be allowed to announce his intention to qualify for Fellowship by being accorded some tangible form of declaration.

Your committee has given several critics careful consideration from many points of view such as geographical centrality, numerical centrality, as well as what might be called financial centrality, and while we are not prepared finally to report to the Board of Regents and to you, the consensus of opinion is strongly in favor of Washington, D. C.

Washington is neutral ground, and with the home of the College located in this capital city the activities of this great organization would be free from the suspicion of being controlled by any school, university or group of individuals, or by medical and other politics.

Here a great congress of physicians convenes every third year. Here over one hundred and fifty continental and national organizations have located their homes. In my opinion it is too early in our career to plan for a specific site and type of building. Why not, if Washington is to be selected, try the locality out for a time at least in temporary quarters until we are prepared to say along what lines we are to develop in the home. We should have at an early date an administrative headquarters where records can be kept, board meetings be held, and other work of the College be carried on; and these quarters should be in keeping with the dignity of this great institution. We could then after mature deliberation decide whether or not we are to develop a surgical museum, whether or not we are to duplicate a great medical library already existing there, and whether or not we are to have a great convocation hall or make use of one now under construction as occasion may demand, and further consider many other problems that will confront us.

I feel that the College with its high ideals has come to stay for all time and that no undue haste should be indulged in planning for its future. Those of us who have had to do with some of its early problems

will have passed away before this organization will have attained its full strength and have made its influence for good fully felt. Let our motives stand out so clearly and clean-cut that a Fellowship shall be the aim of every young surgeon, and those who are now standing in doubt of the side lines will unhesitatingly fall in line and join hands with us in this great humane endeavor."

#### ENTRANCE REQUIREMENTS

The general plan under consideration by the Committee on Examination, or future entrance requirements, was outlined by Dr. Edward Martin, Chairman of this Committee.

Our first tendency after the formality of organization and the securing of sufficient number of strong men to make it potent, is to make entrance requirements which in themselves shall be a gauge of capacity. Thus, if wisely planned, assures for this Society a future of potentiality and usefulness beyond our present power of imagination. We want the young men coming on to be better equipped and trained, stronger and more able than ourselves.

Probably every one who has traveled and attended the clinics returns with a great admiration for the work done there and with a settled conviction that if a surgical operation must be performed on himself or any member of his family he will come home and have it done for it is characteristic of the American surgeon that he sees the immediate need of things and goes swiftly and deftly for it. We want the coming American surgeon to be still better than he is of the amphitheater to-day — to play a larger part in the progress and advancement of surgery. Therefore, we propose for this great body a scheme of entrance requirements, not based upon an examination, of which we have a surfeit, but rather upon an investigation into the efficiency of the work he does with his head and hands.

We propose the ordinary requirements in regard to ethical standing, academic education, and hospital residencehip, and some special study under the charge and direction of men of acknowledged skill and large clinical experience.

"The applicant must have served at least one year as hospital interne or house officer preferably in hospital with varied service.

He must have served at least three years as second assistant or one year as first assistant to surgeon of recognized ability and with an adequate hospital service and must supplement his individual report of operations by a further report of at least a hundred cases in which he has thus acted as assistant.

He must show evidence that he has visited other surgical clinics than those to which he has been officially appointed.

He must give list of his publications, indicating those which he has in the course of preparation.

In addition to this, he must show some work done for the advancement of the general cause of surgery.

"Finally he must give a report of his own work showing fifty consecutive cases of major operations done by himself — mark the word consecutive — with the names and addresses of the patients, the names and addresses of the physicians or consultants referring the cases, the pre-operative diagnosis, names of the anesthetists, the anesthetic given, quantity and time of administration, a brief description of the operation with a note of the time required for its performance (calculated from the first cut to the beginning of the application of the dressing), the post-operative course and the mention of its complications, if such have occurred (not only those conditions usually classed as such but consecutive bleeding which calls for measures directed toward its control, hematoma of sufficient extent to require evacuation or drainage, or suppuration as slight as a stitch abscess are to be regarded as complications), the condition of the patient on discharge from the hospital with subsequent course of case up to date of application for membership to the College or as near this as seems practicable.

Each day he works he is preparing for admission, and his summarized records enable the Committee on Admission to judge of the accuracy and efficiency of his work. This means no expenditure of time in preparing for foolish examination. It means that we admit men fit for their work. It means a simple American solution of the question of establishing a standard for admission to a body of practical working men.

#### REPORT OF GROWTH AND FUTURE FINANCIAL NEEDS OF THE COLLEGE

Dr. Franklin H. Martin presented a summarized budget, which represented the future financial needs of the College, in which he said:

Eighteen months ago in New York, the American College of Surgeons was conceived; thirteen months ago it was organized; six months ago

Chicago conferred fellowships upon 1,050 surgeons, and tonight it will confer 253 additional fellowships. In November next, it will confer fellowships on the balance of the Charter Member list of applicants, bringing the whole number to near the three thousand mark.

What is the meaning of this almost superhuman effort — the part of the busiest surgeons of this continent to organize a College of Surgeons that has eventuated in deeply impressing and enrolling in its membership in twelve short months, more than two thousand of the most thoughtful surgeons of two great countries? Whatever motives may be attributed to such a movement by the casual or careless observer, it is only necessary to join its ranks, become part of it and know the character of the men who have worked for its success, to be convinced that great vision of unusual opportunities for bettering the surgery of America, rather than the establishment of an ornamental guild, has been the compelling force in the minds of all who have allied with this remarkable movement.

"Today we have come together as Fellows and prospective Fellow of the American College of Surgeons to make another forward move. We have assembled, as charter members, the active founders of an organization that is a parallel world organization. Each has had an honorable career in our mother country for thousand years. Our Fellows are surgeons, surgical specialists, and citizens will be represented throughout our continent in every university as teachers, in every hospital as members of the staff and in every medical board of state, provincial, or national councils.

Judging from our standards the character of our members the prerogatives have assumed and the far-reaching influence that may be achieved by co-operating our energies, our responsibilities are enormous. The compensation for great responsibilities is great opportunities.

Among our responsibilities we have assumed the standardization of surgery, the standardization of surgeons. To standardize surgery we must co-operate with the graduate and undergraduate teaching institutions of the continent and their hospitals, and with them in establishing more efficient methods of teaching, and higher requirements. To standardize surgeons must co-operate with the people, to employ surgeons and establish their minds the power of discrimination, of this great public opinion that will make efficiency and dishonour in surgery so unpopular that it can not thrive.

We have the the powers of great organization, built on the highest ideals. Our opportunities are obvious. Strong men are back of us and it now remains for us to demonstrate our ability to achieve that which has been placed in our hands.

The ultimate financial budget of this organization at this time can only be hinted at because time will need the upkeep of dignified homes, the libraries, laboratory chiefs, museum curators, executive secretaries and corps of assistants, all directed by competent chiefs.

For the immediate future however we require trained education for executive ability, the broad vision of the needs of the College, the under the direction of the Board of Regents, all conduct the executive business of the College and devote his entire time to the work. This head of the College should have a cabinet of surgeons with whom he should be free to consult at all times, and who with him will constitute the Executive Board of the College. These surgeons should be selected with qualifications as follows:

First, a surgeon who is actively interested in medical educational problems, especially in reference to the undergraduate medical schools, and who will indirectly or by cooperation with other organizations seek to raise the standard of surgical education, and will devote at least one month time each year to the work of the College.

Second, a surgeon of similar inclinations who is especially interested in the problem of the graduate

medical schools, and who will devote at least one month a time each year to the work of the College.

"Third, a surgeon who is interested in the standardization of hospitals and who will by carefully conducted propaganda, use every effort to bring about specific results in this direction, and who will be willing to devote a definite amount of time each year to the work of the College.

"Fourth, a surgeon interested in medical educational problems, who will be willing to assist in organizing legislative and civic committees in states, provinces, and cities where problems of interest to surgeons are being discussed, and who will be willing to devote time to propaganda work of that sort and to the work of the College.

"The plan of administrative control on some such basis as this, in my opinion, should be put into effect at or soon after our November meeting.

"The salary of the chief director should be sufficient to be attractive to any man qualified for the position who would be free to accept it.

"The four surgeons who are to act as advisers and who, with the director will be the administrative committee of the College should receive as compensation a suitable sum per diem for the actual time engaged in College work, and should, in addition, have their traveling expenses refunded. They should be appointed by the Regent and should serve for a definite term of years.

"This committee could formulate rules for admission of Fellow along the lines adopted by the Board of Regents, and could manage the machinery necessary for their admission, subject to the entire control of the Regents as the several committees serving at the present time.

"This strong administrative body is an absolute necessity if the College is to begin the work that is before it and pursue it with the intelligence and persistence that will be required to make it an accepted power. It goes without saying that we will have to pay a trained director who will devote his energies to the College a suitable salary.

It is equally true, unless we are to run a philanthropic institution, that the executive committee of surgeons who shall give several weeks each year to our affairs shall each be paid for the actual time devoted to the College.

These expenses, roughly estimated including the \$1,000 necessary for current expenses, the expenses of the executive officers will not be less than \$35,000 a year. Our income, with our present system of finances, with a membership of three thousand, will be \$5,000.

Aly estimate of expenses for the work of the immediate future (and this does not include the upkeep of a permanent home) it will be seen is \$20,000 a year more than our income.

I am sure, therefore, must provide for the immediate need of the College will be certain at the outset because of inadequate financial support. If we are to have a dignified home, with libraries, museums, and our own meeting hall, we will require

fully as much as the sum I have named in addition for upkeep and salaries, and thus does not take into consideration the initial expense of building.

It be safe, independent and have a financial standing commensurate with the personnel, ideals, and future possibilities of our organization, we should make provision for an immediate permanent income of \$50,000 a year. This administrative fund should be the income from a permanent endowment fund, invested in perpetuity for the benefit of the College.

How shall we raise this endowment? What do we expect to accomplish through the judicious expenditure of the income on such an endowment? Why have three thousand surgeons of this continent been selected Charter Members of the American College of Surgeons? What will future generations of surgeons say when they read over the list of Charter Members of this organization? Will they say "There was happy conception, but they left it to future generations to make it permanent" or will they say "There were giants in those days: men and women of vision, with the courage of their convictions, who knew the pleasure of sacrifice: men and women who planned broadly and executed magnificently."

#### ENDOWMENT FUND

The urgent need of raising one-million dollar endowment fund was presented by Doctor George W. Crile in few concise remarks.

This group of men have become Fellows of the American College of Surgeons by virtue of the fact that each has attained eminence in his profession. Every member of this organization is now in the midst of an active producing career. There are in our ranks to-day no young members just starting in their profession. Our present roll is of successful men.

We owe much to the institutions that helped us in the past. We owe much to the public that gave us the hospitals in which we received our training and to the medical schools where we acquired our education. It was only through the generosity of high-minded citizens that we were given the opportunity for the scientific training which has made our careers possible.

The primary purpose of this organization is not so much to help us as it is to help those who follow us. We are, so to speak, preparing an inheritance for our children. After the list closes next November no one will be admitted to fellowship excepting by an examination. After that time there will always be in this organization groups of young men without means—perhaps still in debt for their education—young men who are making a struggle for existence. As long as this organization exists there will never again be a time in which all the Fellows will have reached their active productive period. Therefore there will never be another time so opportune for offering privilege which every Fellow is able to participate.

"Should it not be our greatest honor to have participated in the endowment of an institution of this character? It is common experience that one's greatest interest lies where his greatest sacrifice has been made. The future of this institution will depend not only upon the endowment that we make but upon the fact that for that endowment we have sacrificed time, thought and money. By sacrifice in its behalf this organization will become a part of us and it will have a newer and deeper meaning for us."

The Board of Regents, after due consideration propose that there shall be circulated ten-day cards for pledges of \$500, payable at some future time.

Each one of us to-day is proud of the fact that he is a Fellow of the American College of Surgeons, and that pride will be increased if we assure the perpetuation of this institution by our gifts and consecrate it by our sacrifices.

Blank forms had been prepared in advance and were distributed to the Fellows at this time. The pledge which is in the form of promissory note reads as follows:

#### AMERICAN COLLEGE OF SURGEONS ENDOWMENT FUND

I hereby subscribe Five Hundred (\$500) Dollars to the Endowment Fund of the American College of Surgeons, the amount to be paid as follows:

Jan. 9		Jan. 9	
Jan. 9		Jan. 9	
Jan. 9			

I further agree to pay on this pledge interest on the balances due at the rate of 5 per cent per annum, beginning January 9, 1915. It is further agreed that this subscription shall be paid unless the subscription to the Endowment Fund equals \$500,000 by December 9, 1914.

Signed

Address

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Immediately following the distribution of these subscription blanks, Dr. John B. Murphy urged every Fellow of the College to assist in raising this endowment fund. He said:

This is to us a special privilege day. It is very fitting that this day and its privileges should occur in the City of Philadelphia. But a short distance from here in Liberty Hall, not so many years ago a small body of men, bent on a definite purpose with positive convictions, with inspiration and foresight founded for all time, a model of human liberty that the greatest good might avail it all. Here to-day we as a body of surgeons should found—on a basis of self-sacrifice, which is substantially the basis on which the founders of our principle of liberty sacrificed not only their wealth but their lives for the principles that they were advocating—a permanent home.

We are doing that for what purpose? Not for

benefit to us, but that the lives and the health of the people of this great nation will, in the future, be better conserved than they have been in the past. Remember the unit around which medical existence, education, and universities revolve and always must revolve, if we are to continue to have the affection, confidence, and support of the people is the individual patient. We must render to that individual patient the best service that we have or can possibly obtain. That individual patient is our ward, is our trust and looks into our eyes feeling that he can depend upon us to exercise the best unit of energy and time and knowledge for him, and we must fulfill his expectations.

"The purposes of this organization have been mentioned to you so clearly to-day and the question has been asked, 'What has been accomplished?' Wonders have been accomplished, and wonders have been accomplished by a few men because they were willing to sacrifice time and labor for the ideals on which they wish to found this organization. The fact that we have in this hall to-day six or seven hundred men, and to-night will have fourteen hundred, many who have traveled thousands of miles, and many who have come here at a great sacrifice of time and money is a certificate of the earnestness of the founders of this organization and of the men who are in the organization.

If this small handful of men, less than dozen, originally only three could produce this great result by living and working for an ideal, what can this grand body of American surgeons do for the surgery of the future?

"Gentlemen that sits with you, collectively, individually. Now who is willing to stand for the purposes of it? What work for its best interests? No one can estimate the great benefit that must come to American surgery and to the American people by our fidelity to the trust which is placed in us.

We shall be asked to-day or has been asked to-day to contribute to the permanent educational fund of this organization. Do I want to contribute? Do you want to contribute? We were once founded in an Orchestra Hall in Chicago. I met men who knew little or nothing about music, and we were discussing this problem. I want to put my name, this man said, 'on the honor roll of a citizen who is willing to make a sacrifice for the art of music. That was the true spirit. I feel that every man here wants the honor of being one of the founding members and have his name enrolled with this grand body of men who are going to place to-day the American College of Surgeons on a financial basis that will stand for all time.

"The funds—how will they be cared for? The funds for the present are in the hands of Dr. Ochsmere the treasurer and his conservatism and name are synonymous with responsibility and trust. It is known all over the world for just such elements as have made him so valuable in the founding of this organization.

"I cannot permit this moment to pass without saying a word for the man who conceived this organization—a man who has stood rebuffs, accumulations, and contumely from one shore of this great land to the other who has shown in his labor and work, that when one is advocating a true purpose the more opposition one has, the more the cause will grow and attract the support of the worthy. Opposition to this has come from organized and unorganized forces. The man who has borne the brunt of the labor who has planned so wisely and all for the American College of Surgeons, who has sacrificed time and money and personal interest for his ideal, the man to whom the major credit is due, is Dr. Franklin H. Martin. It was his dream. It is our realization. It is now your accomplishment and its future is your responsibility.

I think I can say for the Regents of this organization that it is the desire of the American College of Surgeons to join hands in the march of progress with every organized and unorganized agency of medicine and surgery. But while it is its purpose to march with them hand in hand, it is also its determination not to have its course swayed one way or the other by any organization or body of men, not to deviate one iota from the high ideals which have inspired this drama and brought about its fruition.

This was followed by a short talk from Dr. Charles H. Mayo, calling for a liberal response to the request for subscriptions to the endowment fund.

The organization of this College marks the greatest epoch in the history of American surgery. This College is not being developed for our benefit alone as is claimed by those who object to the organization by saying it has made a classified list. What this country wants more than anything is a classified list of able honest men in the profession.

There is nothing in the world really appreciated except that for which sacrifices are made. We appreciate things only in so far as it costs personal ends or. The men on the Board of Regents have worked, and there is no more unselfish worker among them than our General Secretary. It is through his efforts that we have this organization to-day though we have wanted it for years.

We cannot expect that the running expenses of this College shall be paid by the young men who will join after this year because they will not have arrived, and it will not be fair to ask it of them. We owe certain things to the people, and I do not see any better way we can pay our just share for the opportunity that has enabled us to advance and has put us where we are than to do something for the future of our profession. It is a privilege to pay something toward the medical profession to which we belong. This should not be looked upon as a charge. We should not be like the many millionaires who before death have tied up their wealth in every possible way. If they had lived in a state in which there was an income tax on their ill, they would have given away their money.

before death in order to beat the state. Some of the multimillionaires still living have done well, but some of the dead ones have not done so well. And we don't want to ask these outsiders to help us. We owe it to the profession to help ourselves. This sum of \$500 each has been asked for to-day in order to give us a start. There are those who will not see the benefits of this organization for a few years to come, and the Board of Regents must plan some method by which these men when they do come to their right minds, may join us and do so without humiliation to themselves or to us. Many good men have been led astray as to our motives by some medical journals. In the best journals we have not had a word of criticism.

I want to impress upon you that this society must go on that the time is ripe and that there will be no backward step. If we have made a mistake as a Board of Regents in suddenly deciding to day to raise money for the future of the organization, then it means more personal endeavor on the part of each one of us to find a new and better plan.

Finally Dr W D Haggard addressed a few brief remarks asking that the Fellows sign and turn in their pledges at once.

I do not feel that there is anything I can add here, it seems to me at this moment that it resolves itself into a proposition of raising a million dollars in a few months. I believe it is going to be done. \$500 pieces from ten thousand surgeons. What is \$500 to this group of distinguished surgeons. You will earn it in a few minutes after you get home.

I all acclowness seems to me this is an opportunity of lifetime. It has been hinted that this College

would be endowed by some millionaire and we would enjoy it. I feel that we should contribute. We do not need aid but the people of this country need to have a group of men to whom they can look for succor in time of sickness and distress. The purpose of this College is not to shed luster on the members but on the community. The slogan of this College should be "Let no good man be kept out, but let no bad man get in, or stay in."

There has been some criticism on the part of those who have not been admitted to fellowship and there has been some criticism on the part of the medical press but it does seem to me as I stand here and look into the faces of this cream of the surgical profession of this country, the question is answered for all time and I feel, therefore, Mr President, that this opportunity is a transcendent one and every man here can, will and must sign this pledge for \$500.

An informal discussion followed the addresses by the members of the Board of Regents. It was suggested that each five-hundred dollar pledge to the endowment fund constitute the donor a half member of the College and that his membership fee of twenty five dollars be credited on his pledge and that the yearly dues provided by the by laws also be omitted, and, furthermore, that each charter member Fellow who contributed to this fund before December 9 4, should be designated in all future editions of the Roll of Fellows. Founder of the College and that the Board of Regents be requested to provide for such changes in the by laws as might be necessary to carry out these suggestions, and present the same for approval at the next meeting of the Corporation of the College.

## CONVOCATIONS

### THE FIRST CONVOCATION

The first convocation of the American College of Surgeons occurred to the Gold Room of the Congress Hotel Chicago, on the evening of November 13th, 93.

The prospective Fellows were invited to sign the roll of membership at this place during the day. The roll was furnished in loose leaf form and a corps of assistants presided over the formality of signing in manner to make it possible for a large number to be accommodated in short space of time. Each page of the roll was headed by pledge or contract, and to this the Fellow appended his signature and address.

#### FELLOWSHIP PLEDGE

Recognizing that the American College of Surgeons seeks to develop exemplify and enforce the highest traditions of our calling, I hereby pledge myself, as conditions of fellowship in the College to live in strict accordance with all its principles, declarations, and regulations. In particular I pledge myself to pursue

the practice of surgery with thorough self restraint and to place the welfare of my patients above all else; to advance constantly in knowledge by the study of surgical literature the instruction of eminent teachers, interchange of opinion among associates, and attendance on the important societies and clinics, to regard scrupulously the interests of my professional brethren and seek their counsel when in doubt of my own judgment, to render willing help to my colleagues and to give freely my services to the needy. Moreover I pledge myself so far as I am able to avoid the sins of selfishness to shun unwarranted publicity dishonest money-seeking, and commercialism as disgraceful to our profession, to refuse utterly all secret money trades with consultants and practitioners, to teach the patient his financial duty to the physician and to urge the practitioner to obtain his reward from the patient openly. I make my fees commensurate with the service rendered and with the patient's rights and to avoid discrediting my associates by taking unwarranted compensation. Finally I pledge myself to cooperate in advancing and extending, by every lawful means within my power the influence of the American College of Surgeons.

## PROGRAM

8 o'clock fellows and guests assembled  
 8 15 Governors assembled  
 8 30 Reports assembled with honorary guests  
 Invocation by the Rev J G A. McClure  
 Presentation of the Roll of Fellows and Honorary Fellows by the Secretary  
 Conferment of Fellowships by the President  
 Introduction of Honorary Fellow and student by the Regent  
 Request and conferment of Fellowships by the President  
 Fellowship address by Sir Rickman J Godlee  
 Presidential address by J M T Finney  
 Adjournment followed by reception of the Fellow and Guests by the Officers of the College and Sir Rickman J Godlee

## CONFERRING OF FELLOWSHIPS

Sir Rickman J Godlee of London was introduced by Regent W W Chapman. Before conferring the degree the President D J M T Finney received the candidate and said:

Sir Rickman J Godlee student erstwhile then distinguished surgeon, worthy member of a family whose name is known and honored wherever aseptic surgery is practiced. President of the Royal College of Surgeons of England the highest honor the gift of his professional associates at home. His presence here is renewed evidence of the mutual high regard and esteem held for each other by the great English speaking nations.

The President then conferred upon Sir Rickman J Godlee an honorary fellowship in the American College of Surgeons.

William W Keen of Philadelphia was introduced by Regent George W Crile. Before conferring the degree the President received the candidate and said:

William Williams Keen, doctor of America surgery after professional life covering fifty years. As leader of the Jefferson School of Philadelphia he links us with the great professional names of the nineteenth century. Army surgeon, teacher, operator, writer, publicist, tireless patron of art, promoter of the best in higher education, public spirited citizen, recipient of the greatest gifts in American medicine. Honorary Fellow of the Royal College of Surgeons of England and of Edinburgh he is honored throughout Europe. Wherever good surgery is regarded, there he is quoted.

The President then conferred upon Dr William W Keen an honorary fellowship in the American College of Surgeons.

William Stewart Halsted of Baltimore was introduced by Regent Charles I Stokes. Before conferring the degree, the President received the candidate and said:

William Stewart Halsted, surgeon, teacher, investigator, honored at home and abroad, contributor to the progress of science. One of the four distinguished founders of the Johns Hopkins School of Medicine. His gifts to surgical technique, numerous valuable operations, new the standard and many great advances in surgical physiology and pathology have brought to him international

renown. Honorary Fellow of the Royal College of Surgeons of England and of Edinburgh, with undiminished vigor he still pursues his valuable career.

Following this honorary degrees were conferred *à la carte* (candidates being unable to attend because of illness) upon J Collins Warren of Boston and Robert F Weir of New York.

## FELLOWSHIP ADDRESS

Sir Rickman J Godlee, President of the Royal College of Surgeons of England, was introduced by the President, J M T Finney and upon rising was received with prolonged applause the entire audience rising to greet him. Before reading his formal address, he presented greeting to the American College of Surgeons, in the form of an illuminated parchment, from the Royal College of Surgeons of England.

## GREETING FROM THE ROYAL COLLEGE OF SURGEONS

We the Council of the Royal College of Surgeons of England, have heard with much interest of the approaching inauguration of the American College of Surgeons. We hereby convey to it our hearty good wishes, and express the hope that it may have successful career and all position broadened able to the Profession and to the Community.

We cannot forget the important advances in the Science and Art of Surgery achieved by many distinguished surgeons in the Continent of America during the past, and are proud to have enrolled upon our list of Honorary Fellows the names of some of the most able workers in these fields at the present day.

I accepting the invitation for our President to take part in the opening ceremony, desire to show the appreciation the intention of the American College to strengthen the bonds that already unite the Medical Profession amongst the English speaking peoples. It is a sentiment which always meets with cordial response in this country and it is one which this College will endeavor to support by all the means in its power.

I assure myself as he caused the Council Seal of the College to be prominently affixed this 9th day of October 1905.

President RICHARD J GODLEE  
 Vice-presidents G H MARTIN  
 HARRISON J R

Sir Rickman J Godlee then delivered the formal address to the American College.

## ABSTRACT OF ADDRESS

In the first place it is pointed out that it is difficult for anyone and especially for people living in America to appreciate the conditions in England at the beginning of the fourteenth century. Thus as near the end of the middle or dark ages. The military spirit prevailed, science was under dark cloud and medicine as not in advance of other sciences. Surgery as not so much respected as medicine. Surgeons indeed were classed with barbers and for the most part belonged to the Barber Guild which was formed in 1303. It included those who practiced minor surgery but the better

class of surgeons held aloof and formed themselves into the Guild of Surgeons.

Reference was then made to the origin of the guilds in the city of London. They were associations or fraternities of artisans for the supervision of the crafts and for regulating the hours of labor. They became important bodies, and elected the Lord Mayor and Corporation.

More than two hundred years later, namely in 1542 the Barbers Company and the Guild of Surgeons united and were incorporated as the Company of Barber Surgeons. This company existed another 100 years, namely until 1745. They exercised extensive control over the surgeons of the country. They gave licenses to practice and sometimes deprived surgeons of their licenses if they supervised the public dissections which were the only form of anatomical study recognized by law. They appointed lecturers in surgery, possessed a censorship over books, and had other very important duties. The two bodies were, however, incompatible and in 1745 the Surgeons' Company was separated from that of the Barber Surgeons. In 1800 they were established as the Royal College of Surgeons in London, and in 1843 the name was again changed, by a charter of Queen Victoria, to that of the Royal College of Surgeons of England.

The College of Surgeons had its first quarters in the Old Bailey and later on moved to its present house in Lincoln's Inn Fields. The ancient titles of Master, Governors, and Court of Associates were changed to those of President, Vice President, and Council. The corporation consisted of the members. In 1843 a new class of members who were called Fellows was formed, from and by whom the Council henceforth was to be chosen, instead of being elected by the Council themselves as had been the case up to that date. The first Fellows were chosen from the members, being elected by the Council chiefly from the surgeons, assistant surgeons, and lecturers of the metropolitan hospitals, and they also included representatives of the naval, military and India forces. But since that time the ordinary portal for admission to the Fellowship has been an examination — or rather two examinations — which constitute a formidable and searching test of ability. The class of Members now numbers over 7,000 the Fellows number 580.

Reference was then made to the new American College of Surgeons and to the methods of recruiting its Fellowship. After describing in some detail the examinations above referred to, contrast was drawn between the English and American Colleges. Some of the other functions of the English College were passed in review, especially that of the discipline which it can exercise over its Fellows and Members. In connection with the examination for the diploma of membership the question of a uniform system of admission to the medical profession was discussed, and in this connection it was pointed out how in England attempts are being made to secure this result.

I conclude the relations of the Royal Colleges of Physicians and Surgeons in London as referred to and the opinion was expressed that as surgery advances, the tendency will be for these two great departments of the profession to be drawn more closely together.

#### PRESIDENTIAL ADDRESS

President J. M. T. Finney then delivered the presidential address which has been printed in full and distributed to the Fellows of the American College of Surgeons and to members of the profession. In brief he said:

The highest development of the greatest efficiency along all lines of public service relating in any way to our profession. With this as the keynote, the American College of Surgeons was launched by Dr. Finney on what is thought by all concerned to be a career of usefulness for the public at large. The history of surgery in the United States and Canada, said Dr. Finney, is opened to a new page. When at some future time the historian comes to write on that page the record of events that have led up to this meeting, he will record the taking of another step in the progress of medicine in general and of surgery in particular. Canada and the United States. What is commended here to night is destined to produce deep and lasting impression upon medical progress not alone in those countries but indirectly the world over.

The present and future welfare of the profession has been for a long time uppermost in the minds and very close to the hearts of many of us. We have pictured to ourselves this connection a profession ennobled by men actuated solely by their desire to devote their time and their talents to the relief of suffering humanity willing, yes, glad at any time, if need be, to lay down their own lives for those of their fellow men whose membership should embrace only men of singleness of purpose, unselfish, high minded, zealous in their efforts to wrest from nature the keys to her many mysteries, men who unconsciously perhaps, in character and conduct, reflect in varying degree the life and spirit of the Great Physician, profession free from taint of commercialism or graft in which there shall be no room for the base, the unscrupulous, the ignorant, or unskilled in which the test for membership has to do only with character and attainment.

Our hopes and dreams, so long dim shadowy and unreal, are about to assume definite and concrete form. We are assembled here this evening to witness, indeed to assist, at the birth of a new agency for good, both to the public and to the profession. It is Godspeed to this lusty infant, the American College of Surgeons, the offspring of a fruitful union between a deep rooted and praiseworthy desire within the profession to elevate its standards of ethics and efficiency and a lively sense of the urgent and long felt need of its accomplishment.

The aim of this organization and the reason for its existence lie in its disinterested and unselfish

efforts to elevate the standards of the profession, moral as well as intellectual; to foster research, to educate the public up to the idea that there is difference between the honest, conscientious, well-trained surgeon, and the purely commercial operator for the charlatan and the quack; furthermore, that the term surgeon means something more than a swave member, a club tongue, a private hospital, press agent, and the all too easily acquired diploma, with its accompanying title of "doctor." The standardization of surgery is absolutely essential to guard the public against such as these, as well as to preserve the honor of the rank itself. So far as the public is concerned, it is necessary to protect it from those who would prostitute their high office for gain, from the ignorant and the untrained, from those who by reason of the lack of surgical judgment and skill are incompetent. The American College of Surgeons has been called into being as an active, vigorous, virile protest upon the part of the profession against this unhappy state of affairs.

The public and professional minds should therefore be at once thoroughly disabused of any wrong impression that the College is to be run by any one man or set of men or by or in association with any pre-existing organization for his or their personal gain or aggrandizement. The American College of Surgeons is no surgical trust, no close corporation for the benefit of the few. It plays no part whatever in medical politics; it does not interest itself in the advancement of any corporation or group of individuals nor in any special school or cult of medicine. It stands only for the good of humanity and the uplift of professional standards.

## THE SECOND CONVOCATION

The second Convocation of the American College of Surgeons was held in the ballroom of the Bellevue Stratford, Philadelphia, on the evening of June 9-14. Here Prospective Fellows were invited to sign the membership roll during the day.

### PROGRAM

- 8:00 Fellows and Guests assembled
- 8:00 Governors assembled
- 8:30 Candidates for Fellowship assembled
- 8:35 Regents assembled with Honorary Regents
- Invocation by Bishop Philip M. Macdonald
- Introductory remarks by the President
- Presentation of the Roll of Candidates for Fellowship by the Secretary
- Conferring of Fellowships by the President
- Introduction of Honorary Fellows individually by the Regents and conferring of Fellowships by the President
- Fellowship Address by Dr. James G. Mumford
- Concluding Remarks by President J. M. T. Finney
- Adjournment, followed by an informal reception

### CONFERRING OF FELLOWSHIPS

Dr. Edmond Souchoo of New Orleans was introduced by Regent Rudolph Matus. Before conferring the degree, Dr. J. M. T. Finney received the candidate and said:

Edmond Souchoo, American of French descent, himself of the best French training. Eminent as a teacher, anatomist, surgeon, sanitarian, and original contributor to the literature and technical advancement of his profession. Ingenious in devising graphic methods of illustration; the teaching of anatomy. Founder and organizer of an unrivaled museum of anatomical, surgical and pathological dissections, all prepared in a masterly fashion with his own hands, and mounted and preserved with extraordinary effectiveness by methods of his own invention. conspicuous in surgery—among other enduring contributions by his monumental history of the subclavian artery and its lesions,—he exemplifies the highest ideals of the great Southern school in connection with which his life's work has been done.

Dr. Francis J. Shepherd of Montreal was introduced by Regent Frederic J. Cotton. Before conferring the degree the President received the candidate and said:

Francis John Shepherd, author and teacher for over forty years, a conspicuous figure in the world of surgery. Educated in the best professional schools of his own country and abroad. Representative of the highest culture and best traditions of the Canadian school. Recipient of the highest honors here and at home. Honorary Fellow of the Royal College of Surgeons of England.

An Honorary Degree was conferred in absentia upon Dr. Thomas Addis Emmet whose name was presented by Regent W. D. Haggard. The President said:

Thomas Addis Emmet, a Virginian born and reared, whose distinguished work has been done in the North. A survivor of the antebellum surgery he himself has entered fully and successfully into the modern era. One of the first and best known of American gynecologists, as operator, teacher and practitioner he was leader far beyond his own generation of the surgical giants of our America in the nineteenth century.

### FELLOWSHIP ADDRESSES

Dr. James G. Mumford of Clinton Springs was introduced by President J. M. T. Finney and delivered the fellowship address.

Concluding remarks by President Finney. Adjournment was followed by an informal reception.

### APPLICATIONS FOR FELLOWSHIP

Nearly four thousand applications for fellowship in the College had been filed up to June 1914. Of this number the Committee on Credentials recommended to the Board of Regents 1,059 for fellowship at the first convocation, and 1,055 at the second convocation. A large number of the applications still on file will undoubtedly be found to represent successful candidates, when they have been considered by the Committee.

### FUTURE CONVOCATIONS

The Third Convocation and the annual meeting will convene in November 1914, the date and place to be announced later.

## FELLOWSHIP ADDRESS

## THE PRACTICAL AND THE IDEAL

BY JAMES G. MUMFORD M D F A C S CLAYTON SPENCER NEW YORK

LET us admit that this is a workaday world. It is a region in which practical persons are placed to get things done. But it is a world of ideals also, and without ideals the practical man is as naught. In politics, in literature, in the arts and in science we must see the end and a proper purpose, else our practice is but as ashes between the teeth. Great purposes call for great men. If we cannot all be great, let us at least strive for that leveling up which the democratic shibboleth teaches— for indeed leveling there must be, and let us agree with Carlyle that gallant purposes and heroes are not all dead. One recalls a spirited passage from that trenchant writer. I am well aware that in these days hero-worship professes to have gone out and finally ceased. This is an age that, as it were, denies the existence of great men—denies the disabilities of great men. Show our critics a great man, a Luther for example, they begin to what they call account for him, not to worship him, but take dimensions of him,—and bring him out to be a little kind of man! He was the creature of the Time, they say, the Time called him forth, the Time did everything, he nothing but what we, the little critics, could have done too! This seems to me but melancholy work. The Time called forth? Alas, we have known Time to call loudly enough for the great man, but not find him when it called.

Now observe that great purposes, great endeavors, as well as heroes, draw the same words from the critics. We are met here with a fine and genuine purpose, and after much endeavor. Is it nothing that we strive to elevate and to dignify the calling of surgery? Is it nothing that we see our short comings, and strain after better things? Is it nothing that some of the best minds in America have lent themselves to these thoughts, and that hundreds of us have come together with earnest purpose? Our censors, a dwindling band, may cry out that we are a company of idealists, and that we shall accomplish no practical object. Let us examine this matter somewhat, and that our ideals and our practice be clear in our own minds, let us submit ourselves first to the chill of definitions.—

An idealist—what is he? An idealist I take to be a man who strives after perfection. An idealist is not a visionary. A visionary is a man who seeks the impossible. All great men have been idealists, and all great purposes ideals. Julius Caesar was an idealist, so were Augustine and Columbus, Hildebrand and Alfred, Erasmus and Vesalius, Cromwell and Cavour, Washington and Robert Lee, Edison and Eliot,—but these men were sound practitioners as well. Who, then, shall define the practical man if we must divorce the practical man from the idealist, and bring them up by hand in separate groups? Are practical men those who are conscious of their own incapacity—the corner grocers of life, the mere children of routine? Such persons do pride themselves on being practical. Disraeli makes Coningsby say of them. In the language of this School, a practical man is a man who practices the blunders of his predecessors.

There is the story of the Irish farmer who took his thirty pounds of butter in to the market at Cork — butter loaded on a donkey one saddle-bag holding the thirty pounds of butter the other balancing with thirty pounds of stone. To the inquiring friend who asked why he did not balance and lighten his load by putting fifteen pounds of butter in each bag Patrick retorted in displeasure "My grandfather loaded this way and what was good enough for him is good enough for me."

But let us not rule the practical man out of court. I take it that the proper practical man is that sane idealist with wit and knowledge to bring his plans to fruition. There is the bogus practical man and there is the true practical man — two personalities always to be distinguished. Mark them. The bogus practical man is the man without vision and so without ideal. Such a man can never be truly successful in this land. His purposes are not ours. At bottom we are a nation of idealists. All our history shows it. The bogus practical man is the snug, shrewd fellow who sees some occult knavery in the acts of his neighbors whose own temperament is knavish to whom the word "service" is a word of derision whose sole purpose is his own advancement and the accumulation of dollars. That is his word of words and he will tell you that money is power. We used to be told that knowledge is power. Now my friends, we who know the world know that this sort of practical man, this self-centered man, this bogus fellow is a fool. He does not acquire knowledge, he does not acquire friends, he does not acquire power, commonly he does not acquire money. Rarely do we hear of him beyond the corner on which he plies his trade. Yet he sneers at honest men as idealists and as visionaries.

The true practical man, on the other hand, sees that genuine success, that distinguished purposes, can be reached only through frank cooperation, through organized effort, through community benefit, through generous competition. These qualities, these tools of progress, stand for and bring those good things which the bogus fellow seeks vainly through his methods of a crude individualism.

In our own case when we increase our collective efficiency, when we render a fuller and more honest public service, when we secure and confirm the respect of the community by so much not only shall we improve the status of our profession but we shall strengthen immensely our own individual cases as members of that profession. The satuous civil laws governing biological research in Great Britain, the degraded imbecility of the judge in the recent animal experimentation case here in Pennsylvania, the mortifying and ignorant evasions of the daily press when dealing with occasional medical affairs and their equally offensive howls when they have conceived cause for rebuke — all these may be matters for our silent scorn and derision. But such a situation is not a happy and stimulating situation. Instead of being thankful for the rare discriminating silence, we should look for intelligent appreciation, judicious interest, restrained and balanced support. As has recently been written of us, — we repeat it modestly I trust — "When the intellectual history of this time comes to be written, nothing will stand out more strikingly than the empty gulf in quality between the superb and richly fruitful scientific investigations that are going on and the general thought of other educated sections of the community." The deep fundamental reason for the value of scientific work is that as a class we scientific men honestly seek the truth. Instinct and

experience teach us that lacking the truth established with every forward step our progress would be vain. In that we differ from all the others—the metaphysicians, the clergy, the lawyers, the writers—they are partisans and advocates they hold their briefs. And so perhaps the greatest function that science as a whole has to perform is the setting up of high standards, thus teaching to men square dealing, straight seeing, just thinking, truth telling, and temperance in statement in precept and in practice.

Much of this may sound like preaching, but my argument is driving at this—that we here, as members of this College, have an opportunity collectively and individually to uphold standards and to forward greatly a branch of science which appeals peculiarly to all men. More than others of our kind we are continually in the public eye, and so much the greater is our responsibility.

Let us admit humbly that we of this College encounter skeptics and critics in the medical profession and even in our own ranks. Let us meet their criticism by performance. These doubters tell us sundry unpalatable things—that we represent a local group, that they have axes to grind, that some persons are cat's-paws, that our organization is an imitation, that we cannot influence the community, that bad surgery will flourish in spite of us, that pernicious fee splitting cannot be eliminated, and that we assume a holier than thou attitude which will alienate good men.

While much of this talk is carping and jealous, still, much of it is honest, and we should not disregard it. Let us sift it for a moment. The allegation that we are a local group disproves itself at once. Glance at our list of officers and Fellows—and it will be seen that we represent the honest surgery, general and special, of the continent. That criticism of parochialism at least is not well founded. We hear it said that there are axes to grind. Who shall say? We trust not. The criticism is so general and so nebulous that it cannot be answered specifically. The same charges are made against all voluntary associations. In a sense they all have axes to grind. If not, why should they exist? But who shall define that ax-grinding purpose? If critics mean that we propose to improve American surgery, to amend our individual status, to hold incompetents at a distance, perhaps to influence the public, as well as state and federal legislation—doubtless the ax-grinding charge is true. But we are not exclusive, all honest, competent men and women, after proper scouting, are to be admitted to our ranks. This ax-grinding charge, so far from showing moral turpitude, represents an honorable ambition. As to the cry of cat's-paws, Who are the designing ones, and who are the dupes? The personnel of our well known and distinguished Board of Regents renders that cry ridiculous. Then we are charged with being an imitation of the English Royal College. Why not? That is an excellent model in fact, however the charge is absurdly untrue. Our method of incorporation, our lack of grading our numbers, and our form of government and administration disprove the statement.

There remains the one serious and adverse charge—that we cannot influence for good the profession and the community, and that our purpose is chimerical.

That is a matter for our earnest consideration. I have already referred to it. What do our critics mean by this cloudy prognosis? They tell us that a stream cannot rise higher than its source—a true saying and worthy the literary acumen of these doubters. Such a statement in this connection

would be ludicrous did it not show a pathetic ignorance of life and of historic values. Proverbs and legends fortunately do not rule the world. No progress in human affairs ever would have been made had our race sat supine waiting for the source to elevate itself. And who are these fellows that prattle of sources? The sources of human endeavor I take it lie in human needs and those sources are raised by united human effort following the prophets and the gallant leaders. Are we to admit now that foresight and courage have been lost from among us?

Again what are the sources of good American surgery? Where are they to be sought? Our critics talk as though these sources were to be found in the weary rank and file among the general practitioners, among the over-driven and the less expert. Shall we admit this? Shall we look there for our sources, much as we admire and respect these much over-worked men? In all human activities, indeed we demand a high general average if distinguished action is to evolve but the true sources are to be found in the fountains and not in the low-lying springs. The sources of all distinction lie in the precepts and in the examples of leaders. And these leaders need for their fullest development sympathetic human stimulus and human appreciation. The teacher without a following falls, the most devoted scientist — even a Fabre — without pupils and an audience, eventually will relax. All this means, and history shows, that a competent, well-trained earnest body of men with definite practical objects in view and under distinguished united leadership invariably succeeds. So much for our leading purpose — the maintaining of high and honorable standards.

How is the community to profit? Obviously by the steady raising of our surgical standards and ethics but especially by the recognition and the practice of having their surgical dealings with a company of men and women united jealously to guard and to maintain those standards and those ethics. The time must shortly come when all men shall recognize the letters of our diploma as a genuine *sign manual*.

Here, perhaps, is the place in which I might be expected to say some word on the subject of fee-splitting — that evil practice against which we have set our faces. A few words such as I have previously spoken must suffice. What is fee-splitting? *It is the buying and selling of patients.* The public knows little of this naughtiness. Even if you explain, they see little wrong. Fee-splitting is practiced at times by the merchant, the shopkeeper, the clergyman, the lawyer, the farmer and the mechanic. Obviously it means a commission, a bonus, or a "rake off" for the good will, the good word, or the friendly act of a fellow-craftsman. But fee-splitting in ordinary business is a mild offense or no offense at all, and differs from medico-surgical fee-splitting in this that in ordinary business the customer is not necessarily made to suffer because there is commonly a recognized fixed charge for commodities and for service. The customer knows this and counts upon the inevitable profit of the middleman. If a farmer can produce eggs for fifteen cents a dozen, and if the customer pays the grocer thirty cents a dozen, there is no secret connivance anywhere in the transaction. Thirty cents is the market price and the customer knows that the fifteen cents profit is somewhere properly divided between the farmer and the intervening grocer. The same rule is recognized as proper and true of other commodities. The public knowing the market prices, expects to allow for reasonable profits, and expects to pay more than the

cost of production. Medicosurgical fee-splitting is another matter and occupies a bad position peculiarly its own. It is graft. It is blackmail by the general practitioner. It is bribery by the gulfy surgeon. Through such transactions the unscrupulous surgeon buys his patient from the unscrupulous family doctor as surely as he buys flour from the grocer. *Fiat justitia, ruat cælum.* Again let us scan our ethics and let the crusade advance.

Finally there is that holier than thou reproach. How are serious and self-respecting men to meet such an accusation? If a man tells me that I am a donkey no amount of argument will convince him to the contrary. That is a point of view. We set a standard, and we try to live up to it. We may fall short of our ideal but that is no argument for setting no standard at all.

As one stands here looking into the faces of this great company moved by a common object, shall not one feel stimulated to an expression of hope and purpose, even though the spirit of prophecy no longer walks freely abroad? Without purpose and a genuine program no enterprise shall long endure. But *we shall* endure, and there are reasons for our conviction.

First, we plan, as has been so often said, to set a high standard for American surgery. We have already admitted those men only who gave proofs. By proofs we do not mean necessarily the mere writing of papers for medical journals — that fatuous and exaggerated test of ability which may or may not be evidence of worth. By proofs we mean the faithful daily routine care of the sick using the best methods, applying the best technique, accommodating our hands to the facility of our tools but more than all, through study through devotion, through self-effacement through whole-hearted probity through staging the scene always for the patient and never for the operator to develop that elusive and rare product of common sense, known among the elect as surgical judgment. We do not open our ranks to men of age and wide experience only. We recognize eagerly the contributions of progressive and accomplished young surgeons. The diplomas of their schools, hospitals, and states certify to their right to practice. A few years of further independent experience qualify them for our examinations and admission to the College. We count on their interest and support. Every one of them must join us, for on them shall depend finally our future, and the success of this endeavor. We must not neglect to do missionary work among them. We are weary, wary and experienced in many things. They are fresh, unreflecting and joyous but they too must assume the *loga virgula* and the burdens. So shall they mature in an atmosphere of purpose and resolve.

Secondly it is not too early for us to be considering matters of state and national legislation. Collectively we can bring to bear on lawmakers our convictions regarding animal experimentation, questions of public health, quackery, legal responsibility and medicolegal abuse, especially those standards of surgical education which shall qualify a man to take in hand the lives of his fellows. For this surgical responsibility is a great and pressing matter and grows more serious as years pass. The old imperative surgery which dealt mainly with the removal of tumors, the healing of fractures, the relieving of obstructions, and the checking of hemorrhage, was a relatively simple thing and was readily comprehended by the courts.

The modern surgery of choice, which deals as well with tissue reconstruction, with repair with the problems of physiology and chemistry with the restoration of function, with normal growth and development, and finds itself concerned with all the organs of the body irrespective of their vital significance,—this new surgery demands surgeons of special training, of wide learning, qualified in technique, grounded in the humanities, versatile, patient, wise. The work of such men, the intricacy of their problems, the results of their judgment and the outcome of their labors are not to be measured by foot-rules, to be weighed against dollars, or to be gauged by callow juries. Justice and equity call for reform in medicolegal practice.

Thirdly we have already bound ourselves to discountenance ethical evils. By that we mean especially the division of fees. But there are other things. Observe, as I have said elsewhere, that there is a feeble and fatuous word, *etiquette* by which the unthinking are wont to cloak the noble qualities of ethics. Alas! that such a Turveydrop semblance should have been given a precedence by feeble minds that the outward and visible sign should push aside the inward and spiritual grace.

*Ethics* signified originally character. It deals philosophically with conditions which affect the human family for good or ill. *Etiquette* codifies the superficial relations which govern men in the drawing-room or the club. Ethics directs that there shall be honor among gentlemen, *etiquette*, that they shall tread softly and wear evening dress. Hippocrates marked the distinction. That great man, in his oath, struck at the root of the matter and like St. Paul himself gave us rules that shall prove sound through all time.

Good ethics, then, is to be found among surgeons who following the teaching of Hippocrates and Aristotle, of Celsus and Galen, maintain that he is the upright scientist who pursues his art by the light of sound reason who draws his conclusions and guides his practice by deductions founded on accurate observation who observes that clear inductive method which is older than history who abhors exaggeration and pretense who practices square dealing who conducts himself toward his fellows and toward the public as a generous and honorable man.

Fourthly to the end that these and other good things may be the more effectively and securely accomplished it has seemed to the far-seeing men who conduct our affairs that this College should have a permanent physical foundation—a home of its own. Wherever such a home may be placed its almost imperative need and value are apparent. Beneath its roof should be gathered our essential equipment—a dignified hall for convocations suitable examination rooms for our candidates proper offices social meeting rooms a proper library of current and periodical surgical literature, which should also house and protect the many objects of historic value which time shall store in our archives and perhaps also a carefully selected and representative museum.

Through such means a home for the College will prove pleasant and profitable, but this home will be of far the greatest value to us as a human center as a common meeting ground for men embarked in a common pursuit. Indeed, we have come strongly to believe that without this meeting ground our purposes and our enterprise itself may come to naught. We men are gregarious creatures we have our customs, our habits, our folk ways, and our modes of speech. We say that in undertaking this College

we have a common purpose—and yet as a rule, we know little of each other. We often live far apart, we view the world and its details from different angles, we have our local notions, prejudices, ambitions. Experience of civil life in a democracy teaches us how easy it is for men with a common purpose, but without a common background, to drift apart, to cultivate antagonisms, to form parties. Even among men of science, and of clear perception, these things have been troublesome in the past. To differ in opinion is our human attribute, but among us differences should not bar the horizon; they should lead merely to effectiveness—provided we come to know and understand each other. Acquaintance, friendly knowledge, good fellowship—these are pleasant and comfortable experiences, and through them, cultivated beneath a common international roof, let us believe we shall unite effectively for the work we have in hand.

Such are some of our immediate purposes, and such are some of the thoughts, obvious enough, which come to mind as one views the future.

Mr. President and Fellows, the American College of Surgeons has been the hope of idealists for more than a generation. Now after two years of practical effort we see it accomplished. With Horace, fervently let us say

*Labitur et labetur in omne volubilis ævum*



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\*Deceased

# FELLOWS OF THE AMERICAN COLLEGE OF SURGEONS

The following list contains the names of the surgeons upon whom fellowships in the American College of Surgeons were conferred at the first convocation on November 13, 1913, and at the second convocation on June 1914. Nineteen hundred applications are in the hands of the Committee on Credentials. These will be considered as rapidly as the documents are completed. Other applications for this Charter Member group will be received until November 1914. Successful candidates will receive their fellowships at the convocation to be held in November 1914.

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Birmingham  
Selma  
Birmingham  
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Montgomery  
Birmingham  
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BURTON HARRIS	Brooklyn	WILLIAM LINDEN	Brooklyn
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WILLIAM H. HARTWELL	New York	JOHN H. LONG	Brooklyn
HERMAN EMIL HAYD	Buffalo	ROSE GEORGE LOOP	Elmira
JAMES R. VAN HAYD	New York	LARL P. LUTY	Buffalo
IRVING SAMUEL HAYDEN	New York	MICHAEL MILTON LUTY	Cortland
HAROLD M. HAYS	New York	WILLIAM HENRY LUCKETT	New York
CHARLES HENRY H. LUTY	New York	WILLIAM C. LUTY	New York
ALFRED M. HELLMAN	New York	STEPHEN H. LUTY	Brooklyn
WILLIAM TOD HELLMUTH	New York	HENRY HAMILTON MOORE LUTY	New York
LAWRENCE HENDRIX	Buffalo	JEROME M. LUTY	New York
CHARLES W. HENNINGTON	Rochester	ROBERT STEVENSON MACDONALD	Mattitbsburgh
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FREDERICK CLARA HOLDEN	Brooklyn	JAMES A. MACLEOD	Buffalo
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RANDOLPH S. APARD HOOKER	New York	GEORGE HOOVER M. LUTY	New York
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JOHN J. McGRATH	New York	MARTIN REHLING	New York
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FRANCIS W. MCGUIRE	Buffalo	FREDERICK G. RITCHIE	New York
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PERCY R. TURNER  
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H. H. TYRON

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J.  
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ALBERT VANDER VEER  
EDGAR A. VANDER VEER  
JAMES N. VANDER VEER  
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ARTHUR HURTON VAN LOON  
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WILSON WARD  
WILLIAM DOUGLAS WARD  
ALTON GRAMAM WERT  
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JOHN ELMER WEISS  
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JAMES APPERLY WINT  
RICHARD WARD WINTBROOK  
JOHN FONDA WARD WINTBROOK  
FREDERICK WITTING  
ROYAL WHITMAN  
SIDNEY FREEMAN WILCOX  
NELSON W. WILCO  
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THOMAS WRIGHT  
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New York  
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Brooklyn

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Greensboro  
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Grand Forks  
Grand Forks  
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Minot  
Bismarck  
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Fargo  
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DAN FRUIT GRA  
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CHARLES SUMNER HAMILTON  
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SOL M. HARTZELL

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Zanesville  
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Portsmouth  
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Portsmouth  
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Cleveland  
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Columbus  
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 GUSTAV A. HODGEN  
 CHRISTIAN R. HOLMES  
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 ROBT. J. JONES  
 JONNY G. KELLER  
 LESTER KELLER  
 CYRUS A. KIRKLEY  
 IRVING LAFLEY  
 SECOND H. LAROE  
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 FLORIAN FREEMONT LAWRENCE  
 JOHN NICHOLAS LEWIS  
 WILLIAM E. LOWER  
 BENJAMIN BYRNE MCCLELLAN  
 WILSON M. MCCLELLAN  
 GORDON F. McKIM  
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 DUDLEY WHITE PALMER  
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 GEORGE HENRY QUAY  
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 JOSEPH RAMBOHOFF  
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 GOODRICH BARRETT RHOODES  
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 CHARLES FRYE SANBOR  
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 C. I. SAWYER  
 HARRY M. SCHUFFELL  
 CAMERON M. SHEPARD  
 "PERCY SHIELDS  
 ROLAND E. SKEEL  
 HARRY GORDON SLOAN  
 LEWIS FREDERIC SNEAD

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CHARLES NORTH SMITH  
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Toledo  
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 Warren  
 Columbus  
 Akron  
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 Lorain  
 Columbus  
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 Cleveland  
 Cincinnati  
 Cincinnati  
 Massillon

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 ABRAHAM LINCOLN BLENN  
 WILLIAM EDWARD DICKIN  
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El Reno  
 Oklahoma City  
 Oklahoma City  
 Oklahoma City  
 Oklahoma City  
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 Oklahoma City  
 McAlester  
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Portland  
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SUPREMAN F. WRIGHT	Portland	WILLIAM LOUIS ROOMAN	Philadelphia
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PATRICK HENRY KELLEY	Providence
LOUIS KENYON	Providence
ANDREW JOSEPH McLAUGHLIN	Providence
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CHARLES W. TOWSE	Newport
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Houston  
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Galveston  
Temple

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Lead  
Hot Springs  
Deadwood  
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Aberdeen  
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Salt Lake City  
Salt Lake City

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*VERMONT*

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CHARLOTTE FAIRBANKS  
WILLIAM STICKNEY  
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St J hawbury  
Rutland  
Rutland  
Burlington

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WILLIAM T BLACK  
PERRY BROGERS  
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DUNCAN EYE  
DUNCAN EYE, JR  
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Memphis  
Knoxville  
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Memphis  
Chattanooga  
Nashville

RICHARD PHILLIPS BELL  
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# BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS IN SURGERY

By M. G. SEELIG, M. D.

SOMEHOW or other as the books come for review month after month, one may sense a common purpose characterizing them—purpose oftentimes more or less indefinite and indeterminate and yet sufficiently well marked to make its presence felt. For example this month there is an air of the encyclopedic about the review table—almost bewitching attempt to crowd into small compass the accumulated knowledge of lands and ages.

The work on Pain, by Behran, illustrates particularly well this encyclopedic tendency. Never before has such treatment of pain been written. As an example of patient plodding through literature, careful correlation of data, philosophic deduction and of completeness it has every stamp and aura of classic. These ery characteristics indeed mark it off and set it apart as a different class from that other great classic on pain, written by Hilton in 1877. Let anyone who finds himself interested, bethrilled or concretely the subject of pain, pick up the Index to the Surgeon General Library and turn to the heading *Pain*. If the string of titles that greets his gaze does not totally confound him, it may force him to realize the enormity of the task that Behran set for himself when he started collecting his notes.

To attempt to review the book with any degree of manifest intelligence is in itself a task bearing in mind limitations of space. To be at all adequate a review of so many congregated facts should smack of the lengthy criticisms written by eminent philologists when new dictionaries are published, but about the best way to furnish the reader reasonable ideas of the book is to abstract for him the table of contents. There are, all, thirty-five chapters, opening with a discussion of the psychology of sensation, followed by six chapters on the nature of pain, the distribution, perception, classification of and intensity of pain. Then follow five chapters on pain diseases of the brain, cord and nerves; pain in the tissues, bone pains, and pains caused by the glandular and circulatory systems. The next chapter introduces the subject of regional pain and is followed by a discussion, in four chapters of pains caused by diseases of the eye, ear, nose and throat.

The next twelve chapters discuss abdominal pain first in general, and then under the head of the various abdominal viscera. Pain due to the male and female genital organs occupies two chapters, and is followed by the three closing chapters on pains in the chest and in particular those referable to the heart and lungs.

By way of broad generalization one may say that practically anything that he desires to know about pain he will find adequately described clearly referred to in an excellent index and consequently classified in a most complete bibliography. Occasionally one notes here and there a lapse as for instance the failure to mention Meitzner and Auer's work on the sensibility of the peritoneum and the crediting (by a misprint) of Sieder's work on the sphenopalatine ganglion to Suerdt. But if one desires to know about the work of Head and Sherrington and Holmes on epacritic, protopathic and deep sensibility or about Lennander's work on the peritoneum, or if the innervation of the bladder or of the cord tracts transmitting sensibility or if that matter of any of the basic fundamental physiological or clinical phenomena of pain, he will find clear and accurate summaries or restatements, thus sparing himself the task of going to original sources.

Of course all that we have said so far merely confirms our introductory statement that the book is encyclopedic, and this in turn means that it is not readable in the sense that one reads an ordinary medical book. There is so much refinement of classification and so much wealth of detail that assimilation is simply impossible. The author's attempt to classify pains due to the appendix for example, leads both him and his reader into a snarl of complexity.

For the most part the illustrations are excellently clear and diagrammatic. One cannot help guessing that the author's purpose in inserting art photos of voluptuous young women, totally nude evidently complacently free from pain, posed in enticingly æsthetic postures and labeled "Pain on going upstairs. Lacing shoes posture. Pain on hyperextension, etc." But after all, no really enjoys the ease with which he interprets such pictures as contrasted with the difficult interpretation of the modern æsthetic and cubist art cults.

ONE would not rally expect a treatise on pyelitis to be encyclopedic for the simple reason that the subject lends itself easily to such treatment. What shall we say however to an author who purports to describe the method of nephropexy and then sets about accomplishing his purpose by first describing fifty odd different methods in detail. Such is the method pursued by Luzzor who, in addition, reports various discussions held on the subject of nephropexy before the French Association of Urology and the New York Surgical Society.

The Albarran-Manson method of performing nephropexy is described as follows:

1. Curved lumbo-abdominal incision.

Grasp the fatty capsule as far posteriorly as possible and incise it.

3. Free the kidney from all adhesions and deliver it.

4. Incise the true capsule along the renal border, from the upper pole to the two fingers of the lower pole.

5. Strip back the capsule on both sides and by incising each half of the capsule transversely make four flaps of the capsule.

6. Transfix the base of each of these flaps with number three catgut wire and knot the sutures in place.

7. The two upper sutures are passed through the tenth interspace and there knotted in place. This greatly draws the kidney up under the ribs.

8. The two lower flaps of capsule are then transfixed with sutures, as were the upper ones, these sutures being sewed into the deep surface of the loin muscles.

9. The fatty capsule is tucked under the lower pole of the kidney and held there by catgut suture.

The lumbar wound is closed around a small drain.

When we have mastered this technique we have abstracted the substance from the book. Of course one cannot wilfully and deliberately choke off all admiration for such an excellent résumé of the literature as Luzzor presents but most of us have so thoroughly surfeited of the broad general question of pyelitis, and in particular of nephropexy, that it is necessarily burdened with a tedious as a fresh.

The book serves one excellent purpose namely that it is a storehouse of information for those who have the inclination, properly re-enforced by the necessary endorsement, to investigate the question of nephropexy from earliest times down to the present.

DE LA HYPOPHYSE. French. ALBARRAN-MANSON. Par Dr. John Luzzor. G. Baillière Paris 1911.

AND here finally is the real encyclopedic, controlled by fate under the name of Annual and treating of everything, in alphabetical order from antrix to yellow fever. These volumes have been appearing for thirty-two years. It would be presumptuous, therefore, to say that they do not serve at least some utilitarian purpose. Indeed it is fairly easy to conceive of men, far removed from the library facilities of urban centers, patiently waiting for the appearance of their annual Annual in order to post themselves on the medical happenings of the past eleven months. Of course, a much more satisfactory even if but more strenuous method of accomplishing the same purpose would be to subscribe to one or two good medical weeklies.

Those who are accustomed to digesting their medical literature and arriving at their own critical judgments, there is something repulsive, even partially offensive in a scintillating abstract of the year's product—something that arouses mild spirit of revolt akin to that felt by the medical teacher against the innumerable half-baked quiz compends published for lethargic students. Such volumes always have a perfidious tone, a sort of set task atmosphere that must be more or less disquieting to every reader except him who really does not for his Annual. It is all such evident back work. Take for example that portion of the Annual devoted to stomach and duodenum. It is done by Sir Berkeley Moynihan in the very short compass of five and half pages, and mirrors neither the part nor the body of Sir Berkeley's almost charm, without grace and what is more important without criticism. And it is not this that we object, not the fact that the work is an encyclopedic or that it abstracts literature. The *Real Encyclopaedia* of the Germans, and work like our *Progressive Medicine* which is frankly an abstract journal, are valuable contributions to medical literature despite their encyclopedic character.

We would not have assumed however that our criticism is totally destructive for there is not a little to commend the volume. The contribution of Professor Von Noorden on thorium and that of Dr. Lawson Brown on tetrachlor therapy are excellently complete and specific. Dr. Purves Stewart writes very fully of tetanus and the article on yphitis by C. F. Marshall furnishes good review of progress. Of course, realize that if all the articles in the book had conformed in scope to those above mentioned, one volume work would have been out of the question but even so, we cannot see much of unqualified value in the pretentious condensation aimed at in this Annual.

THE MEDICAL ANNUAL, A YEAR BOOK OF TREATMENT AND PROGRESS. Edited by John Luzzor. 1911. 800 pp.



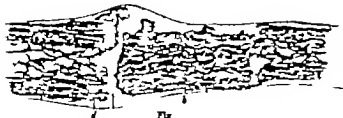


Fig. 3

Fig. 3 day Exp. N. 7  
Transplant with perosteum on  
Old dead cortex  
a New bone  
b Intermediary callus  
c End of fragment with dead  
cortex  
d Long cortex

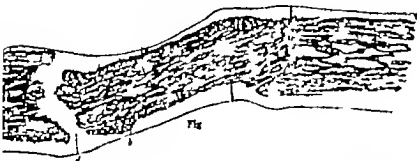


Fig. 4

Fig. 4 day Exp. N. 33  
One half of the shaft split long  
radially: perosteum and en-  
dosteum on  
Old dead cortex  
a New bone from perosteum  
b Intermediary new bone from  
endosteum  
c Intermediary callus  
d Bone union lower end



Fig. 5

Fig. 5 day Exp. N.  
Perosteum on transplant but not  
on ends of fragments  
a Dead cortex no substitution  
b New perosteal bone  
c Fragment end with only  
trace of callus  
d Bony medullary callus



Fig. 6

Fig. 6 day Exp. N. 41  
Perosteum removed from trans-  
plant and fragment ends  
a Old cortex increase of at  
b New bone  
c Intermediary callus upper  
end  
d Bony union lower end  
e Dead cortex of fragment end  
largely substituted



Fig. 7

Fig. 7 day Exp. N. 46  
Perosteum and endosteum both  
removed  
a Callus formed on transplant  
from surviving callus  
b Dead cortex  
c Intermediary callus



Fig. 8

Fig. 8 day Exp. N. 60  
a Bone union at callus  
b Bone endosteal callus  
c Bone intermediary callus  
d Cortex with cells dead

Fig. 9 day Exp. N. 73  
Long delay in union of fracture  
union at the site  
from

Fig. 9

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## THE FATE OF TRANSPLANTED BONE AND REGENERATIVE POWER OF ITS VARIOUS CONSTITUENTS

B D B FLEMISTER M D

From the Archibald Scott Fellowship for Surgical Research, Rush Medical College, Chicago

**B**ONE may be transplanted experimentally for the purposes of determining (1) its value as a reparative agent in bony defects, and (2) the viability and regenerative powers of its constituent parts. In the investigations which I have carried on the viability and regenerative powers have been studied not only in bony tissues which were used for the repair of bony defects, but also in those which were transplanted into the soft parts, since conditions of function and in some instances of nutrition differ in the two locations. All of the experiments were performed upon dogs with bone from the same animal, as it has been sufficiently proved that bone from a different animal of the same species behaves in the same manner as that from the same animal but with somewhat diminished powers and that a transplant from a different species acts the same as dead bone or any other foreign body. In both series the experiments have been arranged in groups according to the composition of the transplant, which was varied as follows: bone plus periosteum and endosteum; bone minus periosteum; bone minus both periosteum and endosteum; boiled bone and periosteum alone.

An extensive review of the literature has not been attempted owing to the fullness with which it has been given in a number of recent contributions upon the subject. Particular

reference may be made to the works of Axhausen, Wæder, Frangenheim, Macewen, McWilliams, Cotton and Loder and Mayer and Wehner where the various workers in this field have been accredited with their contributions to the subject. Findings at variance with the views held by certain authors will be mentioned from time to time. The two sets of experiments will be considered separately.

### BONE TRANSPLANTED INTO A BONY DEFECT

When a defect in the course of a long bone is filled in by a transplant nature is confronted with three tasks to perform, namely:

I The preservation of nutrition and re-establishment of circulation of the transplant.

II The union of the ends of the transplant with the ends of the fragments.

III The transformation of the transplant into a duplicate of the normal bone whose place it fills.

An analysis of the experiments based upon these three considerations will first be made, after which a detailed description of each will be given under a purely anatomical classification.

### I THE PRESERVATION OF THE NUTRITION AND RE-ESTABLISHMENT OF THE CIRCULATION OF THE TRANSPLANT

This is the most important of the three considerations for upon its success or failure

is dependent to a considerable extent, the outcome of the other two. From the standpoint of technique the conditions most favorable for the preservation of the life of the cells and the reestablishment of the circulation are perfect hemostasis, perfect asepsis and perfect coaptation of transplant and soft parts. The presence of a blood clot about the transplant interferes with its early and free permeation by serum, which for a time is the only source of nutrition. It also delays the reestablishment of a blood vascular circulation by preventing an early organic union between the soft parts and the transplant. Infection is particularly apt to result in death of the transplant. That this is not always the case however is shown in some of the experiments, and the effects of a mild infection will be dealt with later on. From the standpoint of the transplant itself those cells about the surface and about the ends of the medullary cavity are in the most favorable position to receive nutrition both from serous permeation and from the early ingrowth of capillaries from the surrounding parts, while the cells of the compact bone have erian canals and medullary cavity away from the periphery occupy a very unfavorable location. There is also a great difference in the nature of the different cells. The ossified portions of the transplant i. e. the periosteum and contents of the medullary canal porous spaces, and haversian canals, being loose in structure are readily permeable to lymph and consequently more apt to live. However the bone cells lying in small lacunae surrounded by a very extensive matrix in which there is a dense deposit of calcium salts and communicating with each other by and receiving their nutrition through long, small, and numerous canaliculi present one of the most difficult situations that can be offered for the restoration of a cut-off nutrition. This difficulty of penetration is well illustrated by the fact that more time is required for a living fluid to fix a piece of bone than for a piece of soft tissue of equal size also in decalcification by the marked delay of the process in the central portion of the bone. Degree of cell specialization also plays a part. The blood forming elements of the marrow and to a

slight extent the ossified cells, are more highly specialized than the rest consequently they are more apt to suffer from interference with the supply of nutrition. Where the technique was properly carried out the influence of these factors upon the different types of transplant was noted.

1. *Transplant plus periosteum and medullary contents.* In fourteen experiments ranging in age from 3 to 350 days the most ideal conditions were reproduced. Sections of the lower third of the ulna varying in length from one half to one and one half inches were excised and reimplanted with periosteum and contents of the medullary cavity intact. The results were as follows:

(a) The periosteum and fibrous tissues of the ends of the medullary canal receiving sufficient nutrition and early restoration of blood vessels, live and retain their proliferative and regenerative powers.

(b) The hematopoietic cells of the bone marrow regardless of their somewhat favorable conditions for nutrition, after retaining vitality for ten or twenty days gradually undergo necrosis and absorption. The medullary canal becomes filled with callus at its ends and with a pale staining fibrous tissue throughout the rest of its extent.

(c) The cells of the haversian canals undergo necrosis. In spongy portions the fibrous contents of some of the spaces located about the periphery remain alive and take part in the regenerative process. The entire haversian system is restored by an ingrowth of vessels from the periphery. In case of the deeply situated small canals in a very thick cortex, several weeks or months may be required for revascularization.

(d) The bone-cells, except for a small number about the surfaces of the cortex porous spaces, and larger haversian canals, undergo necrosis and absorption. These changes occur rather slowly. At the end of three or four days the cells all appear alive. By the tenth day about one half have either disappeared or their nucleoli are shrunken or stained poorly. At the end of a month the vast majority of lacunae are empty and the remaining cells show degenerative changes. A few necrotic cells may persist for fifty or

seventy five days before being absorbed. This persistence of bone-cells is to be explained in two ways. Some of them get sufficient nutrition to maintain a feeble vitality for an indefinite period, while other more centrally located and inaccessible necrotic cells persist because of the difficulty with which they are absorbed by the permeating serum. This same delayed absorption of inaccessible cells is sometimes seen in transplanted boiled bone where the nuclei have been fixed by heat and in sequestra due to tuberculosis.

In four experiments ranging in age from 10 to 84 days the excised segment was split longitudinally and one half of it used as the transplant, the medullary surface being exposed throughout its entire length. Conditions in the cortex and periosteum were the same as in the preceding series, but the endosteum and fibrous tissue of the marrow being more favorably located for the reception of nutrition remained alive and proliferated throughout the length of the canal.

2 *Transplant minus periosteum.* In seventeen experiments ranging in age from 6 to 348 days periosteum was removed from the excised segment before reimplantation. The results in the remaining tissues were practically the same as in those of the first series. Very few ossified cells along the periosteal surface remained alive despite the fact that absence of periosteum made nutrition more accessible. Wherever the periosteum was imperfectly removed its remaining cells proliferated and formed islands of callus.

3 *Bone minus periosteum and endosteum.* In three experiments, 21, 46 and 75 days old respectively the transplant consisted of a strip of bone from the crest of the tibia with both periosteal and endosteal surfaces whittled off giving it the appearance of an ivory peg. There was necrosis and absorption of all of its cells except those lining a few of the porous spaces scattered along the medullary surface and a few about the periosteal surface. These scattered surviving cells gave rise to some callus formation, particularly at the ends where fragments and transplant were in contact, as will be seen in the subsequent analysis. In three experiments 9, 27 and 55 days old a segment of radius one inch

long was excised periosteum and endosteum removed and the cortex cut into ten or fifteen pieces which were reimplanted into the defect. Some of the cells of the splinters lived and gave rise to callus formation which surrounded them and which united with the callus from the ends of the fragments to restore the continuity of the shaft. However the great bulk of the bone-cells of the splinters underwent necrosis and in the fifty-fifth day experiment had been absorbed while some substitution of the necrotic portion had begun.

4 *Transplant consisting of periosteum.* Periosteum completely detached was transplanted into the bony defect in four experiments, 10, 41, 70 and 139 days old respectively. In every instance periosteum remained alive and formed an incomplete fibrous band connecting the ends of the fragments, but in no case did it lead to new bone formation and regeneration of the shaft.

Thus we see that in bone transplantation it is almost entirely the non-ossous portions, i. e. the periosteum, endosteum and fibrous tissue of the ends of the medullary canal that survive the marked interference with nutrition to which they are subjected, and later constitute the living portion of the transplant from which its regeneration largely takes place. However that the vitality of these portions does not remain unimpaired will be shown later by the fact that in the healing of the two fractures at either end callus formation is less marked from them than from the periosteum and endosteum of the ends of the fragments.

## II. UNION OF THE ENDS OF THE TRANSPLANT WITH THE ENDS OF THE SHAFT

This process is analogous to the healing of two fractures and is accomplished by proliferative changes leading to callus formation not only from the tissues of the ends of the shaft, but also from those tissues of the ends of the transplant which survive the transplantation. In order to obtain the surest and most rapid union between the ends there are two factors of great importance aside from favorable conditions of nutrition in the parts to be united. These are perfect coaptation

and perfect immobilization. When perfect coaptation is obtained a small amount of callus is formed and the smaller the amount of callus the more rapid is its transformation into bone. Also when the approximation is good there is considerable stress thrown upon the bone and the ends of the transplant and fragment are forced against each other from the tension exerted by the soft parts of the extremity. In other words, under these circumstances the bone early resumes a part of its function which resumption of function is a powerful stimulus to the osteogenic tissues both of the transplant and ends of the fragments to repair the existing defects in continuity of the bone. Perfect immobilization is essential because mobility both increases the size of the callus and traumatizes its intermediary portion, causing hemorrhage and serous accumulation between the ends and consequently delay in the process of ossification. The mechanism of fixation may be of two kinds: either an external appliance in the shape of a splint or plaster of Paris dressing or an internal arrangement whereby the fragments and the transplant are held directly together. The latter method may be accomplished in man by suturing or plating by the inlay method of Albee or heat of all by impaction of the ends of the transplant into the medullary canal of the ends of the fragments, a method which has been so extensively worked out and perfected by Murphy. As much internal fixation should be obtained as possible because partial immobilization and partial support of the limb by the transplant itself acts as a stimulus for osteogenesis on the part of its surviving cells. In working upon small bones of the dog the above methods of fixation are impracticable and the transplants in these experiments were simply wedged into the defects frequently with considerable angulation and imperfect coaptation with the ends of the fragments. It was in the imperfectly performed experiments that the above mentioned results from faulty technique were observed.

Before further discussion of the method by which union occurs between the ends of the fragments and transplant it is advisable to review briefly the healing of a simple fracture.

This occurs by the formation of a callus from the two ends of the bone which callus bridges over the defect. It consists of three portions: i. e. periosteal, medullary and intermediary and goes through three periods of transformation: the period of fibrous callus formation, the period of ossification, and the period of reduction and consolidation. There is considerable overlapping of these periods but this is the order in which they occur. Fibrous callus formation comes first and all three portions go through this stage.

The periosteal callus forms almost entirely by a proliferation of the inner or cambium layer of the periosteum. The more superficial bone-cells may decalcify and multiply as may also the cells of Volkmann's canals, but their part in the formation of callus is a very minor one. It begins to form within the first twenty-four hours, and reaches its maximum size at the end of the second week.

The medullary fibrous callus forms from a proliferation of the endosteum and fibrous tissue of the ends of the medullary canal filling it for a distance of one half to two centimeters in either fragment. Its formation is complete as a rule by the tenth day.

The intermediary fibrous callus forms last from an ingrowth of the periosteal and endosteal callus of the fragment ends, taking the place of the blood clot which primarily fills in the space. None of this callus comes from the fractured surfaces of the fragment ends. The bone cells of the ends of the fragments for a distance of one third to one-half centimeter undergo necrosis and absorption as a result of interference with their blood supply. The period of ossification greatly overlaps that of fibrous callus formation, beginning two or three days after the first callus is laid down and continuing for three weeks to several months before the process in the intermediary callus is complete. Ossification always begins on the surface of the bone and extends gradually to the more distant portions of the callus. In the medullary portion it occurs by direct transformation of the fibrous cells into bone-cells without an intermediary cartilaginous stage. It always begins on the wall of the canal and extends gradually to the central portion of the callus.

being complete first toward the very end of the canal. Ossification is as a rule complete in twelve to fifteen days. This early bony callus is very spongy and imperfectly formed. In the periosteal callus the process is different. Early ossification along the surface of the cortex is by the direct transformation of fibrous into bony cells, but after four or five days when the callus has reached considerable dimensions a zone of cartilage increasing in thickness toward the intermediary callus usually appears in front of the zone of ossification. As ossification proceeds this zone of cartilage gradually approaches the surface shortens toward the seat of fracture and finally passes over entirely into the intermediary callus. Ossification of the cartilaginous zone occurs largely by metaplasia or the direct transformation of cartilage cells into bone-cells but to some extent particularly when the amount of cartilage is large and the process is delayed by the enchondral method or death of cartilage-cells with substitution by the ingrowing bone. The intermediary callus is last to undergo ossification. It begins along the edges within a few days and requires from two or three weeks to months for its completion. Early ossification comes from only two sources. That portion which originates from the medullary canal ossifies by extension of the process from the medullary callus, and the outer or periosteal portion by an extension from the ossifying periosteal callus. After three or four weeks, ossification begins on the fracture surfaces from an outgrowth of capillaries and osteoblasts which have refilled the Haversian canals of the ends.

Diminution in size and consolidation of the callus with rearrangement of its trabeculae and restoration of the lumen of the medullary canal are slowly accomplished in the subsequent months but since they throw no light on osteogenesis they will be given no further consideration. This in general is the process of repair which has been noted by all investigators as Wieder, Curnel and Coudray, Zondek and Zeigler who have made extensive microscopic studies. My observations have confirmed these findings not only in this series of experiments but also in thirty simple

comminuted fractures in which the fate of detached fragments of bone was studied.

To recapitulate briefly the fibrous callus originates almost entirely from a proliferation of the inner or cambium layer of the periosteum, and from the fibrous tissue of the medullary canal. It undergoes ossification by the transformation of its cells into bone-cells. Hence we must say that these are osteogenetic tissues. This is entirely in accord with findings in the study of the development of the osseous system. The long bones are preformed in cartilage which is surrounded by a primitive periosteum. Ossification occurs by the growth into the cartilage of buds composed of blood vessels and fibroblasts from the inner layer of periosteum. These cells or osteoblasts give rise to bone which takes the place of the cartilage. The periosteum continues to play an important rôle throughout the entire period of bony growth. In the event of a fracture at any period of life where the demand for new bone formation is great the periosteum reverts to its early characteristics and shows marked osteogenetic properties. The statement of Macewen and others that callus forms from bone cell only and not from the inner unossified cells of the periosteum is based upon *a priori* conclusions and not at all upon microscopical studies of experiments.

When we study the method by which union occurs between a transplant and a fragment we find that it is very similar to the healing of a simple fracture. The chief differences are that callus formation from the periosteum and endosteum of the transplant is not so vigorous as that from the periosteum and endosteum of the end of the fragment and that bony union requires a very much longer time in which to occur. These are due chiefly to the fact that the surviving cells of the transplant suffer nutritional disturbances which are sufficient to diminish their osteogenetic powers.

1. In seven experiments ranging in age from 3 to 350 days a section of the ulnar shaft was excised and reimplanted with periosteum intact. In general, a spindle-shaped callus formed at the seat of either fracture which had its origin from the periosteal and medul-

lary contents of the ends of both transplant and fragments. In nearly all of the experiments where periosteal callus still persisted it was present in greater amounts on the end of the fragments than on the transplant. Medullary callus was always more extensive in the end of the fragments than in those of the transplant. Union was much slower than in the healing of a simple fracture particularly at the end of the transplant nearer the middle of the shaft. Inspection of the protocols show in Experiment 105 26 days old both fractures united by a fibrous intermediary callus. In Experiment 106 51 day old, there is bony union of the lower fracture but a fibrous intermediary callus at the upper end. In Experiment 107 132 days old there is bony union at the lower end but at the upper end a thin zone of the intermediary callus is still fibrous.

In four experiments from 10 to 84 days old the exposed section was split longitudinally and one half was reimplanted. Callus formation and metamorphosis occurred the same as in the first group of experiments except that the medullary callus from the transplant was more abundant and blended with that from the periosteum of the fragment.

2 In six experiments from 10 to 139 days old periosteum was left on the transplant but cut from the ends of the fragments. A callus formed at the seat of each fracture which in its periosteal portion was of the usual size on the end of the transplant but was usually *very small on the denuded ends of the fragments* the latter being covered by a layer of fibrous tissue. In some instances callus developed from the periosteum back of the denuded surface and grew down over it while in others islands of callus formed where periosteum was apparently incompletely removed (Experiment 138). But in the older specimens some peripheral bony callus developed from the cortex of the denuded end. Callus formation in the medullary canals of both transplant and fragment was the same as in Series No. 1. Bony union is slightly *en retard* of that in the first series as shown by Experiment 130 R where both intermediary calluses are fibrous at the end of 61 days.

3 In seven experiments from 10 to 87 days old periosteum was removed from the transplant. In general the periosteal callus at the fractures was of the usual amount from the ends of the fragments, but very much smaller from the ends of the transplant. Medullary callus formed in the ends of both transplant and fragments but was more extensive in the latter. Bony union was delayed more than where periosteum was left on the transplant, as will be seen from Experiment 173 L, 87 days old, and Experiment 119, 118 days old where the intermediary calluses are still partly fibrous, allowing mobility at both end.

4 In nine experiments from 6 to 348 day old periosteum was removed from both transplant and ends of fragments. In all of these experiments periosteal callus formation at the fractures was very small from the ends of both transplant and fragments. Medullary callus formed in the ends of the canals and gave rise to nearly all of the intermediary callus. Ossification of the medullary callus occurred early and in the regular way but was very much retarded in the intermediary callus. There was a very small amount of ossification in the scanty peripheral callus which was present. Bony union was delayed longer in this than in any other set of experiments. In Experiment 44 L 199 day old 143 R, 393 days old and 143 L 348 day old complete bony union occurred at only one end of the transplant. Removal of the periosteum lessened the size of the peripheral callus and delayed very markedly the process of bony union.

5 In three experiments, 36 and 75 days old respectively, the transplant consisted of a piece of cortex from the crest of the tibia with both periosteal and endosteal surfaces whittled off. In all three experiments there was fibrous union with free mobility at either end. The callus from the fragments was of the usual size and ossified in its periosteal and medullary portions. From the ends of the transplant there was a small fibrous callus with a small amount of ossification in its inner portion along the surface of the bone. The intermediary callus was entirely fibrous except in the oldest experiment where ossification was beginning from the ends of the shaft.

These experiments show that transplanted bone devoid of periosteum and endosteum contains a few surviving cells which result in a certain amount of callus formation at its ends and which participate in the repair of the two fractures. The regeneration from small pieces which is more extensive because of the increased surface and greater facility for nutrition, was previously noted.

6 One of the most convincing evidences of the great rôle played by periosteum in the healing of fractures is seen in the union of a fracture through the middle of a transplant. In three experiments, 25, 35 and 45 days old respectively, the periosteum was left on the fractured transplant. Good approximation and slight impaction of these fractures was obtained before reimplantation. In each instance a spindle-shaped callus formed at the seat of fracture in the transplant as well as at the two ends. In the 25 and 45-day experiments it had undergone bony transformation and union was firm while mobility was present in the fractures at either end, both intermediary calluses of which were fibrous (see Experiment 186 R Fig 7 Frontispiece). This rapid bony union of the fracture through the transplant while that at either end remained fibrous was due to the better approximation and immobilization obtained by impaction. In the experiments where periosteum was removed there was no spindle shaped periosteal callus at the seat of the freely movable fracture in the transplant and union in the 90-day experiment was by a fibrous intermediary callus in which only a small amount of ossification was present (see Experiment 73 L Fig 8). This proves conclusively that the callus which united the fractures through the transplant in the first series of experiments had its origin almost entirely from the periosteum.

There is usually considerable difference in the processes of ossification at the two ends of the transplant. Larger callus formation and much later bony union nearly always occurs at the end nearer the middle of the shaft, which in these experiments was the upper one. There are two reasons for this: one is the better immobilization of the fracture nearer the end which was quite decided as the ulna was cut off just above the epiphysis, leaving

the lower fragment firmly attached to the lower end of the radius. The end toward the middle is not so firmly fixed consequently movement and displacement are more apt to result. The other reason is that the cortex is thicker toward the middle than at the ends and it is a well known fact that delayed union is commoner in fractures of the shaft with a thick cortex and narrow medullary canal than in those of the epiphysis with a thin cortex and a larger canal filled with spongy bone from which bony callus formation rapidly occurs.

### III TRANSFORMATION OF THE TRANSPLANT INTO A DUPLICATE OF THE NORMAL BONE WHOSE PLACE IT FILLS

This is a purely compensatory change. The transplant is called upon to perform the function of the missing bone which it will do more nearly if its form, size and structure are changed to that of the missing portion. In case the defect is filled in by the unaltered excised portion as in some of these experiments, no alteration in form will be necessary except that demanded by any malposition of fragments but where a transplant of different size and shape is used transformation will be called for in proportion to the degree of variation. An internal transformation is also brought about by the nutritional disturbances resulting in death of nearly all of the bone cells. The living cells of the transplant proliferate and form new bone which gradually takes the place of the dead portions. Blood vessels and osteogenic cells from the surviving peripheral portions gradually grow into and dilate the haversian canals, depositing circumferential lamellae of new bone as the old is absorbed. This is the so-called creeping substitution of old bone by the new which process continues until all of the dead cortex is replaced, requiring from three months to a year or more for completion, depending upon the size and density of the transplant. The surviving superficial portions which bring about this transformation are the periosteum, endosteum, and some of the bone cells.

1 In those experiments where periosteum and endosteum were left on, substitution of

the dead cortex by new bone occurred most rapidly because the transplant contained the greater amount of living osteogenic tissue. In Experiment 105 31 day old about one-fifth. In Experiment 107 132 day old about one half. In Experiment 113 330 day old all of the old dead bone had been substituted by new.

2. In those experiments where periosteum was removed and substitution occurred from the living osteogenic cells of the endosteum and surface of the bone transformation was slower than where periosteum was left on. Thus in Experiment 123 L 87 day old only a very small amount. In Experiment 144 R 64 day old about one third. and in Experiment 143 L 248 day old five eighths of the old bone had been replaced by new.

3. When both periosteum and endosteum were removed and the surface whitened away there were only a few surviving cells from which osteogenesis and transformation could occur. Unfortunately there were no later experiments in this group the oldest one being 75 day. In it there was a small amount of callus formation at either end of the transplant and a trace of new bone in some of the superficial porous space without any definite evidence of substitution. Because of the small amount of osteogenic tissue present and the lack of substitution in this case it is safe to say that transformation into new bone would be proportionately delayed in older transplant. Where the transplant was cut up into small fragments as in Experiment 181 callus formation was more abundant but the cells of the interior died and were absorbed which meant eventually a transformation of the dead cortex.

In those experiments where the excised portion was split longitudinally and only one half was reimplanted marked osteogenesis occurred on the part of the endosteum with the formation of new bone throughout the entire length of the medullary canal which rounded off the transplant into a cylinder giving it the shape of the original bone whose place it filled. (See Experiment 123 64 day old.) The process of transformation approaches completion as the experiment increases in age.

4. In five specimens ranging in age from 10 to 200 days the excised portion was balled before reimplantation. It became surrounded by a fibrous covering and some absorption of the dead cortex occurred. A fibrous union formed at either end but in none of the specimens was there as yet any substitution by the ingrowth of new bone from the end of the fragment.

#### ANATOMICAL CLASSIFICATION OF EXPERIMENTS

The experiment except where otherwise specified were performed upon the lower portion of the ulna and consisted in reimplantations of part or all of the excised portions treated according to the series to which they belong. For convenience of description the reimplanted bone will be spoken of as the transplant and the points of contact of it end with the fragment as the upper and lower fracture.

#### 1. TRANSPLANT WITH PERIOSTEUM INTACT

1. Transplant with periosteum and endosteum intact and of the fragments intact.

a. Mature segment of shaft reimplanted.  
3 day experiment No 109 Transplant two third inch long.

Examination shows considerable extra action of blood in the soft parts. About the transplant fracture is lined over and transplant is surrounded by blood clot out of which the transplant is easily lifted. There is a slight swelling of the periosteum at the end of the fragment, but none of the transplant. Fracture at end of fragment decalcified and sectioned en masse. Microscopic examination shows that the clot surrounding the transplant and filling in the gaps at the ends of fracture consists largely of fibrous network. The medullary canal of the ends of the fragment and transplant is filled with blood. Neither the periosteum nor the bone ribs of the transplant show a lesion. There is small amount of blood in the medullary canal the periosteum of the ends of the fragment is not beginning proliferation of the inner layer of the periosteum.

30 day experiment No 113 Transplant two-thirds inch long.

Good approximation. At ends of fragments small spindle shaped periosteal callus at each of both fracture somewhat greater on end of transplant. Thickening of periosteum over middle portion of transplant. Longitudinal section of the

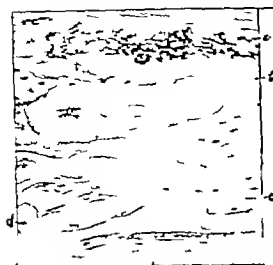


Fig. 8. 6 days Experiment No. 4. Cortex with most of its lacuna, acute (many) cells normal in appearance organizing blood clot below surface. b acute is in normal appearing cells. d extra mixed blood in lacuna cells.

decalcified specimen shows both intermediary calluses composed largely of fibrous tissue but partly of organized blood clot between the ends of the compact bands of the medullary canal of both transplant and fragments filled for short distance with callus.

Microscopically the periosteal callus at the seats of fracture are fibrous except for beginning of ossification along the cortex on the ends both of fragments and of the transplant. The medullary callus filling the ends of the medullary canal at the fracture is partly ossified. The cells of the compacta of the transplant in almost one half of its extent have either disappeared or are very much shrunken and stain poorly. The remaining cells are about normal in appearance and staining qualities. Marrow of middle of transplant normal in appearance.

26 day experiment No. 105 Transplant two thirds inch long

Dog died of distemper twenty six days after the operation. considerable emaciation. Dissect on the seat of operation shows muscles firmly adherent about the transplant. Approximation of the lower end is good. There is slight mobility and union by small spindle shaped callus. Considerable lateral displacement at the lower end in mobility and union by spindle shaped fibrous callus. The callus at the seat of fracture is greater from the ends of the fragment than from the ends of the transplant. When the transplant and ends of the fragment are split open longitudinally the medullary canal is seen to be filled with callus for a distance of half centimeter from the ends.

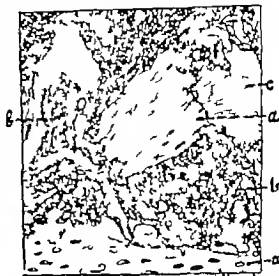


Fig. 9. 27 days Experiment No. 80. Regeneration from chips of cortex with periosteum and endosteum removed. pieces of old bone lacking all callus. b new bone formed from surviving cells, c, fibrous callus.

Microscopically the intermediary callus of both fractures is fibrous but the periosteal callus has ossified except for a thin cortical fibrocartilaginous portion. The medullary callus consists of spongy bone and ossification of the intermediary callus is proceeding both from it and from the periosteal callus. The bone cells of the cortex of the transplant are all dead and nearly all absorbed leaving the lacuna vacant. The periosteum also of the transplant away from its ends is alive and on one side has formed a thin callus which has largely ossified. The medullary canal of the transplant is filled at the ends with bony callus and in its middle portion with dead marrow cells which have been partly substituted by pale fibrous tissue. There is no evidence of either absorption or substitution in the compact cortex of the transplant.

Here the periosteum has formed a partly ossified callus along the entire transplant on one side and at both ends. Endosteum has formed a bony medullary callus in the ends of the transplant. That this bony tissue did not come from the fragment ends by 'osteconductivity' is certain, for there is no bony bridge at either end both intermediary calluses being fibrous. The bone-cells of the cortex are practically all dead and absorbed but substitution by new bone has not yet begun.

51 day experiment No. 106 Transplant four fifths inch long

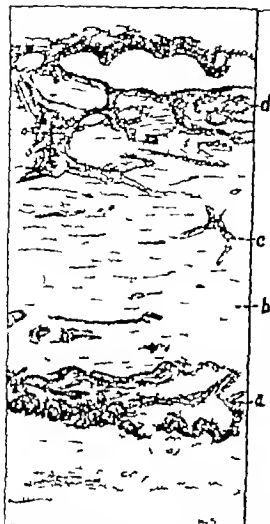


Fig. 5. 5 day Experiment No. 107. Periosteum and endosteum on new bone formed from periosteum; b, dead cortex; revascularized haversian canal; d, new bone from endosteum.

Dissection shows the muscles adherent to the transplant as before operation. At the lower end there is perfect apposition and firm bony union with only slight thickening at the seat of fracture. There is some lateral displacement at the upper end and union is by a large spindle shaped callus which is bony except for the intermediary callus, ossification having occurred from the ends of both the transplant and fragments. There is no enlargement of the transplant except for the callus about its ends.

Microscopically the cells of the compacta are all dead. There is a thin layer of new bone along the

surface of the transplant formed from the periosteum in most of its extent. Toward the ends it thickens and passes over into the spindle shaped callus. The medullary cavity at either end is filled with bony callus which at the lower end blends with that of the end of the fragment, the intermediary callus being ossified, but at the upper end the two are separated by a fibrous intermediary callus. The medullary canal of the transplant is filled from the ends with pale fibrous connective tissue all traces of marrow having disappeared. From the periosteum of the surfaces of the transplant and from the callus of the medullary canal blood vessels have grown into many of the old haversian canals. In many of these canals substitution has begun by absorption of the old cortex and deposition of the new bony lamellae, so that some of the cortex has been transformed into new bone (Fig. 5).

132 day experiment No. 107. Segment three fourths inch long excised and reimplanted.

Dissection shows normal appearance of the glass except for small spindle shaped callus at the seat of the upper fracture. Seat of lower fracture cannot be detected. No mobility at either end. No appreciable thickening along the course of the transplant. Microscopical examination of longitudinal section through the transplant and through the segment shows bony union of the lower fracture by intermediary callus of dense irregular trabecular medullary canal at the seat of fracture contains few coarse trabeculae. At the upper fracture there is spindle shaped callus, bone periosteal and medullary portions are completely ossified. The intermediary callus is ossified from either end except for a very narrow incomplete fibrocartilaginous zone through its middle. The cells of the compacta of the transplant have disappeared leaving the lacunae empty. Revascularization of the transplant has occurred with absorption of portions of the dead cortex and deposition of new bone in its place so that about one half of the old compacta is substituted by new bone. The medullary canal of the transplant is filled partly by pale fibrous tissue but largely by new marrow which is taking the place of the fibrous tissue (Fig. 6). Front aspect.

350 day experiment No. 113. Segment one inch long excised and reimplanted.

Dissection shows an apparently normal glass. The seats of the fractures cannot be detected as there is neither periosteal nor medullary callus to be seen in the location of either. Microscopically almost complete absorption of the old compacta has occurred with replacement by new bone. There are a few islands of old bone to be seen near the upper end of the transplant. The seat of the transplant was easily detected by the irregular course of the fibers and haversian canals as the



Fig. 64 day Experiment No. 142 R. Transplant with periosteum removed. Dead cortex partly substituted by new bone. a, dead cortex with lacunae; b, new bone. New bone is dilated by cranial crurae.

normal arrangement of longitudinal lamellae had not yet taken place.

b. One-half segment split longitudinally used as transplant.

Transplant with periosteum, marrow and endosteum intact but consisting of one half of the shaft split longitudinally.

10 day experiment No. 154. Transplant three-fourths inch long.

There is small amount of thickening of the ends of the fragments here they come in contact with the transplant. The intermediary spaces are filled in by fibrous callus which is partly organized by an ingrowth from the ends. The transplant is surrounded in places by fibers which is full of leucocytes and fibroblasts. There is formation of fibrous callus by proliferation of the inner layer of the periosteum along almost the entire extent of the transplant. There is layer of fibrous callus the exposed half of the medullary canal throughout its entire extent but most is filled at the ends. About half the cells of the compact are still in the transplant have been absorbed and many of those remaining stain very poorly. The ends of the fragments are filled with small amount of new bony and fibrous callus.

33 day experiment No. 70 L.

Dog died of distemper. The soft part is different about the transplant. There is large fibrous callus at the seat of both fracture which is undergoing ossification from the ends of the fragments. There is only small amount of callus formed from the periosteum toward the fragment ends and almost none in the medullary cavity. There is considerable amount of bony absorption, the numerous bony trabeculae being dilated and the

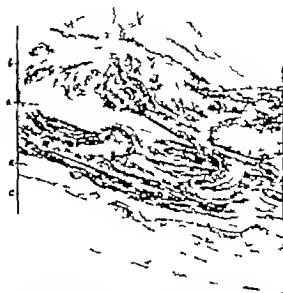


Fig. 343 day Experiment No. 143 L. Transplant with periosteum removed. Dead cortex largely substituted by new bone. a, dead cortex; b, new bone; c, fibrous covering over periosteal surface.

spaces filled by fibrous tissue but no evidences of substitution. The cells of the compact are all dead and have disappeared.

This osteoporosis without substitution by new bone and without extensive callus formation along the surface is evidence that either a mild infection occurred at the seat of the transplant or an extensive hematoma formed about it resulting in death of the greater portion of the periosteum and endosteum and all of the bone cells.

64 day experiment No. 153. Transplant three-fourths inch long.

Considerable angulation of the lower fracture. There is rounding off of the transplant so that it has assumed almost the form of cylinder. There is small bony callus at the seat of the upper fracture and larger fibrous callus at the lower end which permits of some mobility. Microscopically the callus uniting the upper fracture consists of rather coarse irregular bony trabeculae. At the lower fracture where the callus is large is intermediary portion is fibrous but ossification has occurred on the end of both the transplant and fragment. A large bony callus has formed which fills out the medullary canal so that the defective half of the segment is almost restored. Along the periosteal surface there is thin layer of new bone which becomes very much thickened as it passes over into the callus of

the fractures. The cells of the compacts of the transplant has a largely disappeared leaving the lacunae vacant and those which remain stain very feebly. The haversian canals are dilated, giving a coarse character to the transplant. Marked substitution of the old cortex has occurred so that one-fourth of the transplant consists of new bony lamellae which are scattered irregularly throughout the dilated old canals. Substitution is most marked about the periphery (Fig. Frontopiece)

Callus formation along the course of the transplant is very much greater from the endosteum than from the periosteum because of the functional demand on this side for restoration of the defective half.

84 day experiment No 156 Transplant one inch long

Segment somewhat obliquely placed poor approximation at the seat of both fractures. Union at either end by spindle shaped fibrous callus. The transplant is hypertrophied particularly along the course of the medullary canal where the callus rounds it off into a flattened cylindrical form. There is no new bone along the periosteal surface except where the calluses at the ends are ossified. The cells of the cortex of the transplant have all been absorbed, leaving the lacunae vacant. There is revascularization of the bony areas cut with considerable absorption of the old bone and ingrowth of new bone from the surfaces so that the transplant is about one-fourth substituted by new bone.

In this specimen while both intermediary calluses are fibrous the transplant contains bony callus along its entire extent and one-fourth of the cortex has undergone substitution by new bone. This conclusively disproves Dr J. B. Murphy's contention that no new bone formation occurs from the tissues of the transplant and that it acts simply as an osteoconductive agent.

II Transplant with its periosteum on but with periosteum cut from the ends of the fragments for 1 1/2 cm

1 day experiment No 110

Transplant is obliquely situated. There is loose fleshy layer of tissue covering the denuded ends of the fragments and filling in the seats of the fractures. Slight thickening of the periosteum back of the denuded ends. Visible thickening of the periosteum of the transplant on the side of the angle at the lower end. Specimen decalcified and sectioned as usual. Microscopical examination of the end of the fragments shows periosteum bordering on the denuded ends slightly proliferating with ossification in its inner portion. The denuded surfaces are covered by a layer of partly organized blood clot. The

intermediary callus consists of similar material but less highly organized. Ends of the medullary canals filled for two-thirds centimeter with fibrous medullary callus which has begun ossification along the walls of the canal. The bone cells of the cortex for one-half to one-third centimeter from the ends are dead and many of the lacunae are empty.

The transplant. The periosteum at the entire length of the transplant is thickened, but greatest at the ends where it forms callus for the repair of the fractures and has begun ossification along the surface of the cortex. There is small amount of fibrous callus at the ends of the transplant but not to the same extent as is seen in the medullary canals of the fragment ends. The marrow from the ends is practically normal appearance. Most of the bone cells of the cortex are either shrunken or stain very poorly. Some have entirely disappeared leaving empty lacunae. A few scattered cells are normal in appearance. There is no evidence of absorption of the compacts.

31 day experiment No 133.

Dissection shows slight obliquity of the transplant. There is a spindle shaped callus at the seat of each fracture more marked at the upper one. Mobility at both ends. The spindle-shaped calluses have formed mostly from the ends of the transplant. The fragments show slight thickening of the periosteum at its cut margins one and one-half centimeters from the fractures. The surface of the ends which have been denuded of periosteum are covered by a fibrous layer which increases in thickness as the transplant is nearer and takes some part in the formation of spindle shaped calluses. Calluses are thickest on the sides of the angles. Microscopically the periosteal thickening at the cut margin on the fragment is ossified except in its outer portion. The surface denuded of periosteum is covered by this layer of granulation tissue except here it passes into the spindle shaped callus, at which point there is small amount of ossification. In most of its extent the denuded surface shows evidences of lacunar absorption. The cells of the compact near the ends have died and most of them have been absorbed. The larger haversian canals, however, are filled with capillaries which are growing out from the adjacent living bone.

The transplant. The intermediary callus at both ends is fibrous. There is a periosteal callus over almost the entire extent of the surface of the transplant. It is thickest at the ends and is ossified in its inner portion. The bone cells of the cortex and the capillaries of the haversian canals are dead and have been largely absorbed. In a few places, near the ends there has been some absorption of cortex along the surface with revascularization of its areas by ingrowth from the living periosteal tissue. The ends of the medullary canal are filled for half centimeter by fibrous callus which has partly ossified along the surface. The rest of the medullary cavity is filled by dead marrow which is being sub-



Fig. 3



Fig. 4

Fig. 3. Cartilaginous excrescences of upper end of the shaft of the humerus. Fig. 4. Same case as Fig. 3 showing regeneration of shaft three months after sequesterectomy.

stituted by the ingrowth of fibrous tissue. The ends of the fragments are filled with extensive medullary callus which has ossified at the ends and ossification has begun to extend into the intermediary callus.

40 day experiment No. 111. Fig. 3 (Frontspective). Transplant two-third inch long.

In good position. The seat of operation shows thickening of the transplant from the formation of callus along its entire extent. There is small spindle shaped callus with light mobility at the seat of each fracture. Back of the denuded surfaces of the fragment ends there is a ring of callus formed by the free margin of periosteum. The denuded surfaces are covered by a layer of fibrous tissue which has a slight groove between the spindle shaped flaps at the seat of fracture and the rings of callus at the free margins of the periosteum. On the upper fragment bony callus seems to be growing down over the denuded end. Microscopical examination of the ends of the fragments shows the ring of periosteal callus back of the denuded surfaces to consist of spongy bone in its inner portion and fibrous tissue in its outer portion. The

covering over the denuded ends shows a few areas of ossification along the bony surface but in most places there is roughening of the cortex from absorption changes. The bone cells of one half centimeter of the end of the cortex are dead and most of their lacunae are empty. A medullary callus of scattered bony trabeculae fills the ends of the fragments for one half centimeter. The transplant is surrounded

most of its extent by callus arising in thick mass which consists of spongy bone in its inner third and ossification of the remaining portion is proceeding through the interrupted zone of resorption. Each separates it from the outer fibrous callus. On one side of the lower end periosteal callus is absent and a fibrous tissue covers the surface. The cells of the compact bone have practically all been absorbed leaving the lacunar spaces empty. The capillaries of the lacunae which have disappeared but revascularization of the larger ones is occurring by ingrowth from the periphery. In a few places about the periphery of the lacunae canal absorption of the dead bone has occurred and new bone has been built at its end. The marrow of the medullary canal dead in its central portion and it has been substituted by pale staining fibrous tissue. There are only

few bony trabeculae in the ends of the canal of the transplant. The intermediary calluses are fibrous but ossification has begun to extend into them from the ossified medullary canals of the ends of the fragment. There is a cavity filled with fluid in the lower one between the ends of the art. (Fig. 3, front aspect).

This specimen illustrates well the activity of the periosteum when left on a transplant and the scarcity of bony callus on the ends of the fragments where the periosteum has been cut away, also the impossibility of osteoconductivity as an explanation for the new bone on the transplant.

59 day experiment No. 140 Dog markedly emaciated due to distemper

Transplant three fourths inch long. Slight section of the canal with formation of a narrow but still present transplant slightly oblique. There are no visible evidences of infection. Union at both ends by fibrous callus. The mobility at the upper end. Callus at the upper fracture is thick upon the end of the transplant but the portion over the fragment end and the intermediary callus is small. At the lower end there is lateral displacement so that one side of the cortex projects at the medullary cavity of the fragment. Union at both small callus formed from the ends of both the transplant and the fragments. There is no thickening of the transplant except at the ends described. Microscopically both intermediary calluses are rather fibrous. The denuded end of the upper fragment is covered by thin fibrous layer with some absorption along the periosteal surface on one side and by the layer of new bone on the other. It is 1/2 inch thick at its half centimeter of the end. The denuded surface of the lower fragment is covered by this layer of fibrous tissue except at the end where the gap between it and the transplant is filled out by a callus which is ossified at its inner portion. The ends of the medullary canals of the fragments are partly filled by coarse bony callus. The cells of the cortex for about distance of the ends have been destroyed.

The transplant. The callus at either end and along the surface consist of coarse porous bone in the upper portion which passes over to fibrous outer layer with lateral ring cartilaginous zone. The medullary canal is filled by pink fibrous tissue except for small amount of new bone filling other end. The cells of the compacta have all been absorbed leaving the lacuna empty. There has been considerable absorption in distal portion of the haemorrhagic canals. Blood vessels are growing from the periphery and in the canals small amount of new bone formation is seen.

There has been considerable delay in the process of healing in this case because of the weak condition of the animal. There is also

evidence of mild infection as shown by the fluid in the thick coarse bony callus covering the fragment and absorption of the transplant without substitution by new bone. There has been considerable delay in the ossification of the intermediary calluses.

61 day experiment No. 139 R Dog emaciated when killed

Transplant one third inch long in good position. Union at both ends by small fibrous callus. Slight mobility at both ends. There is no perceptible thickening at the ends either of the fragment or of the transplant. Microscopical examination shows that both intermediary calluses are fibrous. The periosteal surface of both the transplant and the denuded ends of the fragment is covered by a layer of fibrous tissue. There is considerable lacunar absorption along both the surface of the transplant and the ends of the fragments and only a small amount of bony callus formation on the ends of the transplant. The medullary canal of the transplant is filled with marrow except at its ends which are bridged over by bony callus. The cells of the compacta are all dead and have been absorbed leaving the lacuna empty. In some places there has been distention of the haemorrhagic canals but only few have been substituted by new bone.

Along the medullary canal there is a layer of newly formed bone. The medullary canal is filled with fibrous tissue except for thin bridges of bone at either end. No marrow tissue is present. It will be noted that the reaction here has been very sluggish due probably to the emaciated condition of the animal.

119 day experiment No. 139 R Transplant two thirds inch long in good position

The rest of the lower fracture cannot be made out. There is mobility at the upper end and union by small fibrous callus. There is slight new bone formation along the surface of the transplant but none on the surface of the fragment ends. The bony union is by irregularly arranged dense trabeculae. The medullary canal at the rest of the fracture is filled with coarse trabeculae. At the upper fracture the intermediary callus is fibrous but that of the periosteal union of the ends of the transplant is bony. A bony medullary callus fills the ends both of the transplant and of the fragment.

The transplant. The cells of the compacta bone have all been absorbed leaving the lacuna empty. About one fourth of the compacta has been substituted by new bone which has formed in the distal haemorrhagic canals.

## II TRANSPLANT WITH PERIOSTEUM REMOVED

Ends of the fragments with periosteum intact



Fig. 5. 64 day Experiment No. 55 B. Periosteal flap back formed. periosteal nodule attached to femur by fibrous pedicle.

In this series there were seven experiments ranging in age from 10 to 119 days.

10 day experiment No. 174

Described in the chapter on the histology of fractures through a transplant.

11 day experiment No. 172 R. Transplant one and one fourth inches long.

Very small amount of periosteal callus on ends of the fragments at site of fracture but none on the transplant. Each is covered by a layer of granulation tissue. The ist medullary calluses are partly fibrous and partly blood clot and do not project beyond the surfaces. Split open longitudinally the ends of the medullary canals both of the transplant and of the fragments are filled with a partly ossified medullary callus. Microscopically both the periosteal and medullary callus has begun ossification long their bony surface the process being more marked in the medullary portions. About one half of the bone cells of the cortex of the transplant have disappeared and some of those remaining are shrunken and stain poorly. The capillaries of the haversian canals are dead and the blood vessel of the large canals stain poorly. Periosteal surface of fragments are covered by a layer of large organized blood clot and in places there is a slight amount of absorption of the cortex but nowhere is there an allusion of the marrow. Marrow of the middle portion of the medullary canal is normal in appearance.

In this specimen there was slight callus formation on the ends of the fragments and in the medullary canals of both fragment and transplant, but there was none on the periosteal surface of the transplant.

26 day experiment No. 69 R. Transplant one and one eighth inch long.

There is good approximation the proximal and distal bony union in medium sized iliac which is ossified in the periosteal and medullary portions. There is an intermediary callus of fibrous tissue which is undergoing ossification from the fragment and lower fracture shows considerable displacement of fragment. There is union by fibrous

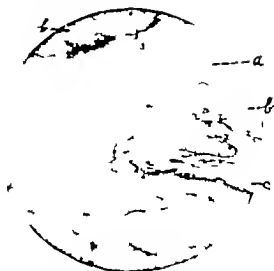


Fig. 6. Photomicrograph of 64 day Experiment No. 144 R. showing creeping substitution of old bone by the new. 'a' old bone, 'b' new bone, new blood, vascular canal.

callus which has partly ossified from the end of the fragment.

The transplant. On one side there is a thin layer of bony callus along almost its entire length. On the other side there is here and there an irregular layer of new bone. The callus on the end is much smaller than on the end of the fragment. The ends of the medullary canals are filled with new bone which is not as extensive as that filling the ends of the canal of the fragment. About one half the cells of the compact of the transplant are dead and many of them have been absorbed. Some stain quite well and others have marked shrinkage of the walls. The medullary cavity is very from the end filled by necrotic marrow.

Here again there is bony callus formation along the surface of the transplant although it is small in amount.

65 day experiment No. 178 U. Segment one and one fourth inches long in good position.

No call formation about it. There is union by small fibrous callus of the upper end. There is union and non-union at the lower end. The top of the transplant is necrotic and sequestration is occurring. At the upper fragment union is by fibrous intermediary callus without a periosteal callus formation whatever. The medulla of the ends of the fragment is filled by bony call for one half inch.

The transplant. There is no callus formation of sort from the entire transplant. The bone cells of the cortex are all dead and most of them have been



The marrow-cells of the middle of the transplant are dead and there is a small amount of substitution by fibrous tissue. The bone cells have nearly all disappeared and those which remain are shrunken nuclei and stain very poorly.

38 day experiment. No. 121 Transplant one half inch long

Considerable angulation at the lower fracture. Dissection shows soft part firmly adherent about the transplant with small spindle-shaped calluses at the seats of fractures, more marked at the upper. The intermediary calluses are fibrous. Free mobility of both fractures. Periosteum back of the denuded ends has formed a ring of bony callus on both fragments and there is a covering of fibrous tissue of moderate thickness about the transplant. Microscopically, the denuded ends of the bones are covered by a thin layer of fibrous tissue in which there is practically no ossification. Toward the ends of the transplant, here the callus is thickest on the side of the angles there is a small amount of ossification along the cortical surface of the bone. The covering of the transplant elsewhere consists of fibrous tissue. Ends of the fragment are filled by bony callus for two thirds centimeter. The ends of the medullary canal of the transplant are filled by a fibrous callus which partly ossified along the surface. The marrow of the middle portion is necrotic. The cells of the compact bony cortex have largely disappeared leaving the lacunae vacant. Capillaries of the Haversian canals are also dead and the canals are largely empty. About the periphery resorption is occurring by an ingrowth of capillaries from the fibrous covering. There is small amount of absorption about the surface and end of the transplant.

41 day experiment No. 122 Transplant three fifths inch long

There was infection at the seat of operation and the formation of sinus which persisted past the time the animal was killed. Dissection shows granulation growing at the seat of operation. The transplant is surrounded by masses of granulation tissue except at the lower end laterally at the termination of the sinus where its surface is freely bony. There is a marked bulbous pedicled callus on the ends of both fragments back of the denuded portion. There is death of the denuded ends and sequestrum formation is occurring. The intermediary spaces of the fractures are filled by serous exudate. The granulation tissue which surrounds the fragments has become intense and completely filled the medullary cavity. There is marked roughening of the surface and absorption of the transplant so that more than half of it has disappeared. Also marked absorption along the surface of the dead fragment ends. The ends of the fragments are filled for one half to one centimeter with bony medullary tissue. Microscopically the entire unabsorbed portion of the

transplant is dead and there is absolutely no bone formation along any portion of its surface.

Infection resulted in the complete failure of this experiment and the rapidity with which absorption is occurring makes the transplant analogous to a sequestrum in a case of osteomyelitis.

164 day experiment. No. 144 R

Transplant three fourths inch long in good position. Firm bony union at the lower fracture with only slight callus persisting. At the upper end there is fibrous union and a large callus, and considerable mobility of the fragments. There is no thickening along the course of the transplant except at the ends. Microscopically the lower fracture united by callus, consisting of irregular bony trabeculae which projects only slightly beyond the surface and fills to some extent the medullary cavity at its seat. The surfaces of the denuded end and the transplant are covered by a fibrous tissue which is indistinguishable from the periosteum with which it is continuous. The large spindle-shaped callus at the upper fracture is fibrous in the intermediary portion but is ossified on the surfaces. The ends of the bones slightly more marked on the end of the fragment than the transplant. The ends of the medullary canals bordering on the intermediary callus are bridged over by a thin layer of bone. Ossification of the intermediary callus is proceeding from the ends of both transplant and fragment. The medullary cavity of the transplant in its upper portion is filled by pale staining sparsely ossified fibrous tissue but toward the lower end a considerable amount of new bone marrow has been formed. The old compact part of the transplant is entirely devoid of cells. There has been marked absorption of the dead bone and dilatation of the Haversian canals with new bone formation so that about one third of the transplant has undergone substitution. This substitution is equally marked on the periosteal and medullary sides (Figs 1 and 6).

Despite the fact that periosteum was removed from the ends of the fragment and from the transplant substitution of the dead cortex of the transplant is taking place and bony union of the fractures is occurring, however it has been much slower in occurring than in the experiment of corresponding age where the periosteum was intact.

199 day experiment No. 144 L Transplant four fifths inch long

In good position. Muscles and tendons adherent very much as before the operation. At the lower fracture there is firm bony union and except for slight irregularity on one side its location could not be distinguished. At the upper fracture there is fibrous union by medium sized spindle-shaped

callus. There is no thickening along the course of the transplant away from its ends. The denuded surfaces of the fragments and of the transplant are covered by fibrous tissue which is firmly adherent and resembles periosteum. Microscopically the lower fracture is united by a callus of irregular dense bony trabeculae. The medullary canal at its seat is almost entirely restored, there being only a few coarse bony trabeculae left. The spindle-shaped callus at the upper fracture has ossified on the end of the bone but the middle zone of the intermediary callus consist of fibrocartilaginous tissue which is undergoing ossification from either end. Small amount of bone in the end of the medullary canal bordering on the intermediary callus. The transplant shows no thickening along its surface. The cells of the cortex of the transplant have all disappeared and more than two-thirds of the old compact has been absorbed and substituted by new bone which consist of irregularly arranged trabeculae and lamellae. The medullary canal is filled by a pale fibrous tissue in which there is small amount of new bone marrow here and there about the periphery (Fig. 4, front view).

293 day experiment No 143 R. Transplant three fourths inch long.

Appearance too good at both ends. There is small spindle shaped callus at the seat of both fractures slightly larger at the lower one. There is firm bony union at the upper end but fibrous union with slight adhesion at the lower. There is small amount of granulation tissue with growth at the seat of the lower fracture. The dead end and the transplant are covered by fibrous tissue resembling periosteum. Microscopically the callus at the upper is great consist of bone except for very narrow incomplete layer of fibrocartilaginous tissue in the intermediary zone. The callus uniting the lower fracture is ossified on the surface both of the end of the transplant and of the fragment. There is very narrow zone of intermediary callus which is still fibrous. The medullary canal filled for half its diameter on either side with bony trabeculae.

The transplant. Cells of the old compact are dead and it is three fourths substituted by new bone. The substitution in most of its extent is more marked. The inner portion near the medullary canal. The new bone has been deposited in regular lamellae along the course of the haversian canals as absorption of the old bone has taken place. The medullary canal away from the ends is filled by mixture of fibrous tissue and new bone marrow which contains some fat.

Despite the fact that bony union at the seat of both fractures is incomplete three fourths of the compact of the transplant has been substituted. The bone-marrow is being regenerated in the medullary canal of the

transplant gradually taking the place of the fibrous tissue which filled the canal in the earlier experiments.

348 day experiment No 143 L. Transplant three fifths inch long.

Soft parts adherent to the skin as before the operation. There is complete bony union at the upper fracture and it is impossible to distinguish its location. At the lower fracture there is slight lateral displacement and an abrupt small spindle shaped callus which permits of slight mobility. There is no enlargement along the course of the transplant except for this slight callus. At the lower end and it is covered by a layer of fibrous tissue which is continuous with and similar to the periosteum. Microscopically the bony callus uniting the upper fracture consists of dense and irregular trabeculae. The bones of the medullary canal at its seat is practically restored to normal. At the lower fracture the callus is ossified on the ends of both transplant and fragment but the middle zone of the intermediary callus is fibrocartilaginous. The contents of the transplant consists of fibrous tissue. The old cortex in regions is entirely substituted by newly formed, irregularly arranged bony trabeculae. In other regions there is small amount of the old cortex with arant lacunae still remaining. The medullary canal is filled with normal marrow (Fig. 12).

In this specimen the transplant is very largely substituted by new bone which instead of having its fibers arranged parallel with the long axis of the bone consists of irregularly arranged trabeculae. Regeneration of the bone marrow is complete. However both substitution and the healing of its fractures are slower than in the 350 day experiment where periosteum was left on the transplant.

From these experiments it is seen that when periosteum is removed from the transplant the end of the fragment or both the peripheral callus at the seats of fracture is much smaller than when periosteum is left on and union of the fractures is thereby delayed. However some peripheral callus forms not only from the growing out of the medullary callus, but also from the bone-cell along the cortex which survive and proliferate. Transformation of the dead cortex into new bone by absorption and substitution, and regeneration of the bone marrow is occurring from the surviving cells of the transplant. This proves conclusively that a transplant devoid of periosteum may be successfully used for the repair

of a bony defect although the restoration is slower than when the periosteum is left on.

### III. TRANSPLANT OF CORTEX ONLY WITH BOTH PERIOSTEUM AND ENDOSTEUM REMOVED

#### 1. Transplant in one piece

##### 21 day experiment. No 159

A piece of the crest of the tibia one inch long was excised, its periosteum and endosteum removed, and the cortex of both sides whittled off so that the transplant consisted exclusively of compact bone giving it the appearance of an ivory peg. Transplant obliquely placed. Approximation fair at either end. There is moderate sized callus and some mobility at the seat of either fracture. Callus is much more marked on the ends of the fragments than on the ends of the transplant. There is a thin fibrous layer covering over the transplant. Microscopically, the periosteal and endosteal portions of the callus at the seats of the fractures are entirely ossified on the ends of the fragments but the intermediary callus consists of fibrous tissue which is undergoing ossification by an extension inward of the process from them. The smaller calluses on the ends of the transplant are largely fibrous but along the cortical surface at the ends there is quite extensive ossification. The transplant is somewhat porous along the medullary side. The cells of the compacta have all disappeared leaving the lacunae vacant but along the medullary side and in these pores some of the cells have lived and there are lamellae of new bone. Revascularization of some of the haversian canals has occurred. Along the periosteal side there is no new bone formation except in the calluses at the ends but the surface is rough from the occurrence of lacunar absorption.

Despite the fact that the periosteum and endosteum were whittled away from this transplant a small amount of callus formation occurred from its ends which has undergone some ossification along the bony surface and some new bone formation has occurred along the medullary side and in the porous spaces. That this new bone formed from bone-cells which lived is a certainty for the intermediary calluses are entirely fibrous, and consequently osteoconductivity as an explanation is out of the question. The few cells which lived about the ends of the transplant have undergone extensive proliferation because of the functional demand in this location for repair of the fractures.

##### 46 day experiment. No 176

The transplant, slightly obliquely placed, consists of a splinter one inch long taken from the crest of

the tibia with its periosteal and endosteal surfaces whittled off. The splinter is somewhat flattened and a little shorter than the space to be filled in. At autopsy the soft parts are adherent about the transplant which is found to be considerably smaller in diameter than the fragments. There is a small fibrous callus uniting both fractures. The transplant is apparently not enlarged. Microscopically the callus at both ends is fibrous in its intermediary portions but has ossified both from the ends of the fragment and from the ends of the transplant, although much less markedly from the latter. The callus formation is more marked on the sides of the angles and ossification of the callus on the end of the transplant has occurred only on those sides. The cells of the bony transplant have practically all been absorbed. There are some large canals and pores along the medullary side into which blood-vessels have grown and there is slight new bone formation along their walls. There is absorption along the periosteal surface where there is no callus formation except at the ends (Fig. 5 Front aspect).

Here despite the fact that both periosteum and endosteum are removed there is a small amount of new bone formation both in the calluses at the ends and in the larger pores along the medullary side. A very small amount of substitution has occurred about these pores.

##### 75 day experiment. No 177

The transplant consists of a portion of compact bone from the crest of the tibia with its periosteal and endosteal surfaces whittled off. Dissection shows no enlargement along the course of the transplant. There is fibrous union at both ends. Considerable ossification of the calluses uniting the fractures has occurred from the ends of the fragments only, very small amount on the sides of the slight angulation from the ends of the transplant. The cells in the remaining compacta of the transplant have all been absorbed. There has been a small amount of revascularization and dilatation of the haversian canals and along the medullary surface a small amount of new bone formation. Along most of the periosteal and some of the endosteal sides there has been some lacunar absorption.

Here too a small amount of new bone formation has occurred from cells about the periphery of the transplant which have lived and a suggestion of substitution of the transplant is present. The importance of functional demand in hypertrophy of the bone is shown by the more extensive bone formation in the calluses where there is demand for union of the fractures.

In this type of experiment where so very few of the transplanted cells remain alive

callus. There is no thickening along the course of the transplant away from its ends. The denuded surfaces of the fragments and of the transplant are covered by fibrous tissue which is firmly adherent and resembles periosteum. Microscopically the lower fracture is united by a callus of irregular dense bony trabeculae. The medullary canal at its seat is almost entirely restored there being only few coarse bony trabeculae left. The spindle-shaped callus at the upper fracture has ossified on the ends of the bones but the middle zone of the intermediary callus consists of fibrocartilaginous tissue which is undergoing ossification from either end. Small amount of bone in the ends of the medullary cavity bordering on the intermediary callus. The transplant shows no thickening along its surface. The cells of the cortex of the transplant have all disappeared and more than two thirds of the old compacta has been absorbed and substituted by new bone which consists of regularly arranged trabeculae and lamellae. The medullary cavity is filled by pale fibrous tissue in which there is a small amount of new bone marrow here and there about the periphery (Fig. 4. Front aspect).

293 day experiment No 143 R. Transplant three-fourths inch long

Approximation good at both ends. There is a small spindle-shaped callus at the seat of both fractures, slightly larger at the lower one. There is firm bony union at the upper end but fibrous union with slight infection at the lower. There is small amount of granulation tissue with fistula at the seat of the lower fracture. The denuded ends and the transplant are covered by fibrous layer resembling periosteum. Microscopically the callus at the upper fragment consists of bone except for a very narrow incomplete layer of fibrocartilaginous tissue in the intermediary zone. The callus uniting the lower fracture is osseous on the surface both of the end of the transplant and of the fragment. There is a very narrow zone of intermediary callus which is still fibrous. The medullary canal is filled for half centimeter on either side with bony trabeculae.

The transplant. Cells of the old compacta are dead and it is three-fourths substituted by new bone. The substitution in most of its extent is more marked in the inner portion near the medullary canal. The new bone has been deposited in irregular lamellae along the course of the Haversian canals as absorption of the old bone has taken place. The medullary canal away from the ends is filled by mixture of fibrous tissue and new bone marrow which contains some fat.

Despite the fact that bony union at the seat of both fractures is incomplete three-fourths of the compacta of the transplant has been substituted. The bone-marrow is being regenerated in the medullary canal of the

transplant, gradually taking the place of the fibrous tissue which filled the canal in the earlier experiments.

348 day experiment No 143 L. Transplant three fifths inch long

Soft parts adherent to the alba as before the operation. There is complete bony union at the upper fracture and it is impossible to distinguish its location. At the lower fracture there is slight lateral displacement and a small spindle-shaped callus which permits of slight mobility. There is no enlargement along the course of the transplant except for this slight callus at the lower end and it is covered by a layer of fibrous tissue which is continuous with and similar to the periosteum. Microscopically the bony callus uniting the upper fracture consists of dense and irregular trabeculae. The lumen of the medullary canal at its seat is practically restored to normal. At the lower fracture the callus is ossified on the ends of both transplant and fragment but the middle zone of the intermediary callus is fibrocartilaginous. The covering of the transplant consists of fibrous tissue. The old cortex in regions is entirely substituted by newly formed irregularly arranged bony trabeculae. In other regions there is small amount of the old cortex with vacant lacunae still remaining. The medullary canal is filled with normal marrow (Fig. 5).

In this specimen the transplant is very largely substituted by new bone which instead of having its fibers arranged parallel with the long axis of the bone consists of irregularly arranged trabeculae. Regeneration of the bone-marrow is complete. However both substitution and the healing of its fractures are slower than in the 350 day experiment where periosteum was left on the transplant.

From these experiments it is seen that when periosteum is removed from the transplant, the end of the fragment, or both, the peripheral callus at the seats of fracture is much smaller than when periosteum is left on and union of the fractures is thereby delayed. However some peripheral callus forms not only from the growing out of the medullary callus, but also from the bone cells along the cortex which survive and proliferate. Transformation of the dead cortex into new bone by absorption and substitution and regeneration of the bone-marrow is occurring from the surviving cells of the transplant. This proves conclusively that a transplant devoid of periosteum may be successfully used for the repair

ated and weakened condition of the transplant they are more stimulated to hypertrophic and reparative changes

#### IV. DEFECT FILLED IN BY PERIOSTEUM

##### A. Subperiosteal resection

1. There were three specimens. 54 and 56 dogs were respectively, in which the ulna full grown was resected subperiosteally. In all three the defect was bridged over by fibrous tissue and in none was there any evidence of regeneration of the shaft from the remaining periosteum. The ends of the fragments were rounded off. Microscopically the bridge consisted of fibrous tissue and the medullary cavity was closed over by new bone very much as one sees in an amputation stump.

Subperiosteal resection of the shaft where there is only one bone in that portion of the extremity is followed by different results.

In 9-year old child where because of cartilaginous exostosis, the upper four inches of the shaft of the humerus was resected by D. Culper and the greater portion of the periosteum left behind 3 months it regenerated the shaft in its entire length as shown by the X-ray photographs in figures 3 and 4.

In young dog operated on in the same way similar but less complete regeneration consisting of spongy bone had occurred when the animal was killed at the end of sixty days. There is no doubt a true bony healing because no union could be kept up on the extremity.

In similar experiment of the same age old dog here the periosteum was even thinner there was only small capsule of new bone formed in the defect at the upper end. This difference in age is explained by the fact that the periosteum in the young is much thicker and possesses a marked inner or cambium layer with marked regenerative powers. Such is almost entirely absent in the old. The difference between the results in the ulna and humeral resections is due largely to the difference in function. The humerus has the entire support of the arm, while the radius is the chief support and weight bearer of the forearm so that in case of subperiosteal resections of ulna and humerus there is nothing like the function taken made upon the former as upon the latter.

2. Subperiosteal resection with reimplantation of excised cylinder of the shaft

8 day experiment No. 53

In young dog with the epiphyseal lines persisting the lower half of the shaft of the radius was resected subperiosteally through a slit on one side and reimplanted small amount of the metaphysis on one side remaining in the epiphysis. Periosteum cut back about the reimplanted piece. Dog died eight days later. Dissection shows upper end

protruding through the slit in the periosteum with considerable overhanging of fragments. Lower end in good position. Except at the upper end the reimplanted shaft is surrounded by periosteum very much as if it had not been operated upon. There is no mobility at the lower end. Specimen was decalcified and sectioned en masse. Examination of longitudinal section shows marked fibrous callus formation from the periosteum about the reimplanted shaft but separated from it in most places by a layer of organizing blood clot. No evidence of ossification in the callus formed from the periosteum. The approximation of the epiphyses with the metaphysis is perfect and there is union by an almost completely ossified callus. No evidence of new bone formation from the surface of the transplant. The medullary cavity of the metaphysis is full of fibrous and spongy bony callus. Separation of the lower end as in the justa-epiphyseal region and the epiphyseal line has been unobscured by the process. About one half of the callus of the compacta of the reimplanted portion have disappeared, and the nuclei of many of those remaining stain poorly.

In this specimen where the shaft was reimplanted and function thereby thrown upon the ulna the periosteum has formed a fibrous callus surrounding the lower half of the reimplanted bone.

21 day experiment No. 184 R. Young dog epiphyseal lines open.

Lower half of the shaft of the radius excised subperiosteally and reimplanted after boiling. The ends of the bone at the lower fracture are in good position. There is considerable lateral displacement at the upper end with the end of the reimplanted segment protruding through the periosteal sheath with mild infection and destruction of a part of the periosteum. There is thickening of the periosteal callus surrounding the lower two thirds of the reimplanted bone. Longitudinal section shows that the lower fracture passed through the metaphysis about half centimeter below the epiphyseal line. The fracture is united by a fibrous callus which is partly ossified from the epiphyseal end. Ossification of the callus formed from the periosteum and surrounding the lower two thirds of the reimplanted shaft has begun at the lower end and extends upward in the shape of callus for distance of 1 centimeters. It is separated from the surface of the shaft by a layer of fibrous callus bone but below comes in direct contact with the bony bone. The cells of the dead cortex are nearly all absorbed. The medullary cavity is filled with dead cells and extra coagulated blood except at the ends where fibrous tissue has grown in.

In this specimen the periosteum surrounding a piece of dead bone which partly supported the extremity was stimulated to the formation of a partly ossified callus about it.

they have a gigantic task thrown upon them in the regeneration and transformation of the transplant. In fact in the last experiment absorption in some portion by the surrounding fibrous tissue has exceeded in amount the substitution by these surviving cells, which had occurred in other so that the transplant is slightly smaller than when inserted. It is probable that after several months when bony union of the fractures is complete the much more abundant bony cells of the fragments would grow into the transplant and take part in its transformation. This is what one would expect to happen in the case of a medullary peg used for ununited fracture where the transplant everywhere surrounded by a callus derived from the medullary content.

2 Transplant cut into several small fragments.

After removal of periosteum and endosteum and scraping the surface well the remaining fragment was cut into twelve or fifteen small fragments which were placed within the defect. There were three experiments, 8, 2, and 55 days old respectively.

8 day experiment No 181

Dog died from listeriosis. Dissection showed no section of bone central. The small fragments are embedded in blood but which partly organically growth of fibroblasts from the surrounding soft part. The entire region is covered by a thick layer of medullary tissue. Microscopically the structure surrounding the fracture fragment consists of cartilage of fibrous tissue, most places have been invaded by capillary blood vessels and partially about the periphery has been entirely replaced by loose connective tissue.

The bone is in some of the pieces almost entirely gone and disappeared while in others most of them were completely disappeared or very poorly. A rule there is no callus surrounding the fragments but in few places islands are present which have undergone partial ossification along the fragments. The ends of the shafts have most part amount of periosteal and medullary bone formation which has undergone ossification along the bone surface but none of this callus has grown out and surrounded by of the fragment. The bone cells in the end of the shaft for one third to one half centimeter are dead or stain poorly as a result of the disturbance of their circulation.

27 day experiment No 180 Young dog

Dissection shows union of the shafts by a thin layer slightly greater than the

shaft and encloses all of the splinters except the ends of the shaft which protrude from the surface. The callus is partly ossified and permits some mobility. The specimen is decalcified and sectioned on a microtome. Examination shows thick layer of callus, a surrounding mass of the pieces which is ossified on the surface of the bone but fibrous in its outer portion (fig. 1). The bone cells of these fragments are mostly dead but some appear alive and at the tip of the medullary shafts are surrounded by fibrous callus without trace of medullary tissue on their surfaces. These cells are practically all destroyed and there is considerable toughening of the tissue by absorption.

The ends of the shaft contain a hardening of periosteal and medullary callus which is ossified except in its more distal portions. The bone cells of the very end of the shaft are disappeared. The bony callus is around each fragment and covers the end of the shaft, a rule separated from that of the other fragment by layers of fibrous and cartilaginous callus so that each fragment has been cemented from each. Bone formation and fixation has proceeded. Hence we must conclude that some cells in most of the fragments have not died and callus formation despite the fact that the great bulk of the bone cells is under gone necrosis.

55 day experiment No 182

Dissection shows medullary canal callus surrounding the fragments, uniting the ends of the shaft and permitting very slight mobility. The callus from the upper end of the shaft is more marked than that from the lower. Some of the pieces of bone are dead and are largely absorbed, but the majority of them is a covering of bone callus which in places connects with that of the other pieces and in the ends while in others it is separated from the rest by intervening fibrous or cartilaginous callus. Practically all of the ends of the pieces have disappeared except the layer of the bone and absorption of the dead cortex by absorption and the deposition of new bone in it distal and proximal.

These experiments show that when small fragments of bone devoid of both periosteum and endosteum are used to bridge over a bony defect some of their cells remain alive proliferate and form callus which plays an important part in the restoration of the continuity of the shaft. However the old cortex of the fragment which dies is gradually absorbed and substituted by new bone. These small fragments show more osteogenesis than the single pegs of cortex which were used in the first series of experiments which is due to the fact that a greater number of cells have access to nutrition and because of the greater

there is a small amount of fibrous callus with beginning ossification in the ends of the canals of the fragments. Cells of the compacta of the transplant are mostly all well preserved (by the heat fixation) but many of them about the surface have been absorbed.

30 day experiment No 186 Transplant three-fourths inch long.

The dog sick with distemper was killed at the end of twenty days. There were no adhesions of the muscles about the transplant. It was encapsulated by a thin layer of fibrous tissue. There was no callus formation at the seats of the fractures neither about the ends of the transplant nor at the ends of the fragments. Intermediate spaces are filled in by fibrous tissue free mobility at seat of each fracture. Microscopical examination of the ends of the transplant shows that there is only a very small amount of fibrous periosteal callus, and a partly ossified callus filling the end of the medullary canal. The cells of the compacta of the transplant were nearly all absorbed. There is a small amount of roughening from lacunar absorption along the periosteal surface and ends. The medullary spaces are partly filled by fibrous tissue.

70 day experiment No 125

Transplant one inch long in good position. Muscles adherent about it. The transplant is surrounded by thin fibrous capsule. At the seats of the fractures there is only a very small amount of callus formation from the ends of the fragments. Loose fibrous union at either end. The segment itself is slightly decreased in size from lacunar absorption along the surface. Fibrous tissue fills the marrow spaces. A very small amount of bony callus bridges over the ends of the medullary canals of the fragments.

75 day experiment No 123

Shows practically the same condition as the 70 day experiment with the small amount of reaction on the part of the fragment ends.

200 day experiment No 127

Transplant three-fourths inch long in good position. Muscles adherent about it. Transplant surrounded by layer of fibrous tissue. Fibrous union and free mobility at either end. A very small amount of bony and medullary callus has formed from the ends of the fragments. Ossification of either fibrous intermediary callus except for a small amount proceeding from the small endosteal and periosteal calluses of the fragment ends. The cells of the compacta of the transplant have all been absorbed leaving the lacunae intact. There is diminution in size of the transplant. The some roughening of its vertical surface from lacunar absorption. Its medullary canal is filled by fibrous tissue except for a few places where thin layer of new bone has formed along the walls of it. There is a small amount of heteroplastic bone formed

from the surrounding fibrous tissue similar to that about the older specimens of boiled bone in the soft parts.

It is to be noted that there is very little reaction on the part of the ends of the living fragments which is in marked contrast to that which occurs when a live transplant is used. The dead bone does not stimulate osteogenesis to the same degree as a live transplant, consequently bony union between fragments and transplant had not occurred much less had there been any substitution by an ingrowth of new bone from the ends. In the oldest specimen some heteroplastic bone has formed on the ends of the transplant from the surrounding fibrous tissue in response to the demand for union with the ends of the shaft.

## VI THE HEALING OF A FRACTURE THROUGH THE MIDDLE OF A TRANSPLANT

In five experiments a long transplant was fractured in the middle and the ends well approximated and slightly impacted before reimplantation. In three specimens the periosteum was removed and in two others it was left on.

1. Fracture through the transplant with periosteum intact.

35 day experiment, No 175

Transplant 2 1/2 inches long. There was mild infection of the wound with discharging sinus. Dissection shows infection at the seat of the upper fracture with death of the periosteum over one centimeter of the end of the transplant leaving the surface bare and the end of the bone sequestered. There is no union between it and the upper fragment whose end is covered by moderate sized partly ossified callus. At the lower fracture there is a firm union by small bony callus. At the seat of fracture in the transplant there is considerable angulation and bony union by a large periosteal callus which is thickest on the side of the leg. This callus diminishes away from the fracture and merely disappears on the lower portion before the lower fracture is reached. On the upper portion it extends up the necrotic end which borders on cavity in which the fistula leads. Longitudinal section shows evidence of slight infection along the entire transplant. The layer of new bone formed from the periosteum surrounding the transplant is very thick and spongy resembling extent and structure the involucrum seen in osteomyelitis. The space between the ends of the fracture through the middle is filled by infectious granulation tissue and leucocytes and there is only a small amount of callus formed at the ends of the medullary canal.

this point. The medullary cavity way from the ends is filled partly by dead marrow and partly by an exudate with only a small amount of fibrous tissue in the lower piece. Union at the lower fracture is by a very small callus which is bony except in its intermediary portion on one side where it is still fibrous. The entire cortex of the transplant is dead and its cells have all been absorbed. There has been considerable absorption of bone along the surface and dilatation of haversian canals by growing blood vessels from the spongy bony periosteal involucrum. Substitution of the dead bone along these dilated canals is illogical.

The influence of infection upon this specimen is marked. It has led to non-union at one end by causing death of the tissues, sequestration of two thirds centimeter of the end of the transplant, and the formation of an involucrum by that portion of its periosteum which survived. It has also produced marked absorption of the dead cortex. The fracture in the transplant healed by a much larger bony periosteal callus than that about either end, showing conclusively that the origin of this callus is from the transplanted periosteum and that osteoconductivity played no part in its formation. The entire cortex of the transplant is dead but it has behaved differently in different portions. At one end where infection was severe it has undergone sequestration, while in the rest of its extent absorption and substitution by new bone has begun. Hence sequestration and necrosis of bone are not synonymous since dead bone may be invaded and substituted by new bone instead of being separated and cast off.

#### 35 day experiment No 172 L

Dog died of distemper very markedly emaciated, so that healing powers were considerably diminished. Dissection shows large spindle shaped callus at the seat of the upper fracture much greater from the end of the fragment than from the transplant, a small callus at the lower end, considerable thickening along the entire course of the transplant, and small spindle shaped callus at the seat of fracture through the middle. All three fractures are slightly movable. There is ossification of the inner three fourths of the large periosteal callus at the seat of the upper fracture and of all of the medullary callus filling the ends of both the transplant and fragment. The intermediary space is bridged over by a band of fibrous tissue in its peripheral portion connecting the two periosteal calluses, but the space between the ends of the cortex is occupied by a cavity filled with serohemorrhagic exudate. At the lower fracture there is likewise

ossification of the medullary callus, of the greater portion of the periosteal callus and of the inter medullary callus except for an incomplete narrow disc in its middle portion. The callus along the course of the transplant is ossified in its inner portion and fibrous in its outer. At the seat of the fracture in the transplant there is a slight spindle shaped periosteal callus with ossification on the ends of the fragments but with fibrous intermediary callus. There is no medullary callus at the seat of the fracture and the medullary canal of the entire transplant is filled with dead marrow except toward the ends which are filled with loose fibrous tissue. The lacunae of the cortex are nearly all empty from death and absorption of the bone cells. Capillaries are growing into the large spaces and haversian canals. A substitution by new bone is to be seen.

#### 45 day experiment No 161 R. Transplant two inches long

Dissection shows slight lateral displacement at both the upper and lower fractures, more marked at the upper. There is medium sized callus with free mobility at either end. At the fracture in the transplant there is very slight ossification, a very small callus and firm bony union. Aside from the thickening at the seats of fracture there is no enlargement along the course of the transplant. Longitudinal section shows ossification of the periosteal and medullary portions of the spindle shaped calluses at the two ends of the transplant, but both intermediary portions are fibrocartilaginous and permit free mobility. The callus uniting the fracture in the middle of the transplant consists entirely of irregular bony trabeculae, and is small in amount both in its periosteal and endosteal portions. The periosteum of the entire transplant is alive, and has formed a thin layer of bone along its surface. The medullary cavity is filled by pale fibrous tissue except at the ends where there is a small amount of bony callus. The cells of the core parts of the transplant are dead and have nearly all been absorbed. Revascularization of the lacunae canals has taken place and in a few places substitution of the old cortex by new bone has occurred. (Fig 6)

#### 2. Fracture through a transplant minus periosteum

#### 10 day experiment No 174 Transplant one and one half inches long

Dissection shows good approximation about the fracture and a layer of organizing blood clot along one side of the transplant. There is moderate enlargement of the ends of the fragments from periosteal callus formation but none at the ends of the transplant nor at the seat of fracture through its middle portion. There is fibrous union with free mobility of all three fractures. Microscopically the transplant long one side is covered by an organizing blood clot without any trace of callus formation even at the seat of fracture. Along a

most the entire length of the other side where it came in contact with muscle there is a thin layer of spongy bony callus. This has formed from cells which have survived along the surface. Whether they were from the deeper portion of the periosteum which was not removed or from the surface of the cortex cannot be stated. The intermediary space of the fracture through the transplant is filled in by fibrous tissue and blood clot. There is no callus formation in the ends of the medullary canal. This seat but a small amount at the seats of the other two fractures. About one half of the bone cells of the cortex are normal in appearance while the other half are either shrunken and stain poorly or have entirely disappeared. There is blood extravasation throughout the entire medullary cavity.

In this specimen there is the usual formation of callus from the ends of the transplant and a small amount along one side where there was no blood clot to interfere with the nutrition of its superficial cells. However this thin layer of callus is not comparable in amount to that which forms in a transplant with its periosteum intact. Union of the fracture in the transplant has just begun by the ingrowth of a small amount of fibrous tissue. Approximation of fragments was so perfect and extravasation of blood into the medullary canals so extensive that no callus was formed from the endosteum at the seat of fracture owing to the shutting out of nutrition.

87 day experiment 173 L Transplant one and three fourths inches long.

Dissection shows good approximation and slight mobility at the seat of all three fractures. Small spindle shaped calluses at the ends of the transplant but none at the seat of fracture in its middle portion. Longitudinal section through the entire specimen shows fibrous union of the upper and lower fractures. There is a small amount of ossified periosteal and medullary callus on the ends of the fragments but none on the ends of the transplant and the intermediary calluses are fibrous except for some ossification proceeding from the ends of the fragments. There is no peripheral or medullary callus at the fracture in the transplant and union is by an intermediary callus which resembles the dense connective tissue surrounding the transplant. A small amount of ossification of this intermediary callus has begun along the fractured surfaces toward the medullary side. The bone cells of the compact have all been absorbed and the medullary cavity is filled with fibrous tissue. There has been no substitution of the dead cortex by new bone (Fig. 7).

These two sets of experiments show the very great rôle played by the periosteum in the healing of a fracture and the importance

of perfect coaptation and immobilization for early bony union. Where periosteum was left on there was callus formation at the seat of fracture in the transplant which underwent ossification before that which united the fractures at the ends. In one case there was bony union in 45 days while the two fractures at the ends were freely movable. On the other hand, where periosteum was removed union was by a fibrous intermediary callus which showed only a small amount of ossification at the end of 87 days. Good approximation and some fixation were produced by impacting the irregular surfaces of the fracture in the transplant and these factors undoubtedly account for the more rapid union of the fracture through the transplant in the first series than of those at its ends where approximation and fixation were less perfect. This very conclusively shows the rôle of periosteum in the healing of a fracture and entirely rules out osteoconductivity as an explanation for the source of the callus uniting the fractures in the transplant, since in all of the experiments of the first series ossification of its callus was either complete or almost so while the intermediary calluses at the ends of the transplant were still fibrous. The endosteum often forms little or no medullary callus at the fracture in the transplant because the bony ends are so closely approximated and impacted that the narrow intermediary space does not permit the entrance of sufficient serum to sustain the life of the endosteal cells.

## VII INFECTION IN TRANSPLANTATION

The influence of infection upon bone transplantation demands special consideration. It occurred in a number of experiments in varying degrees of severity and with different types of transplants. A severe infection with extensive suppuration usually results in death and sloughing out of the entire transplant as in II 2—Experiment No. 122. This happened a number of times but very few of these experiments were reported.

The severe infection may be limited to one end and result in death with sequestration of only that portion of the transplant. In the presence of a mild infection the transplant

may take but its subsequent behavior differs from that of one in a sterile field. When the transplant contains periosteum and medullary contents these structures may survive and have a reestablishment of circulation despite the mild infection. The changes in the transplant resemble very closely those of an osteomyelitis. The surviving periosteum forms a layer of new bone about the cortex which both in its excessive amount and in its coarse spongy character resembles the involucrum surrounding the involved shaft in osteomyelitis. These points are well illustrated by Experiment 175 in V. 1. Absorptive changes in the dead cortex are very much accelerated. The surface is eroded, Haversian canals are dilated and slow deposition of new bone does not keep pace with bone absorption the cortex is rendered somewhat porous in structure.

When periosteum is removed from the transplant infection is much more apt to lead to failure because the cells of the bone itself have a much poorer chance than the periosteum to get sufficient nutrition and consequently are all killed by the infection with the result that there is no proliferation and regeneration from the transplant. The mild infection rapidly disappears, the transplant is retained and substitution has to occur by an ingrowth of new bone from the ends of the fragments. Experiment No. 178 U in II, 1 illustrates such a result before substitution has begun. If the infection is at all severe the ends of the shaft into the defect of which the transplant is placed are affected. Excessive callus formation and sequestration of a portion of the cortex may result as in the case of an infected compound fracture.

Slight infection of bone plus periosteum and marrow transplanted into the *soft parts* may stimulate osteogenesis from the surviving portions and hasten absorption of the necrotic cortex as seen in Experiment 175 IV.

#### BONE TRANSPLANTED INTO SOFT PARTS

When bone is transplanted into the *soft parts* conditions of nutrition because of the close approximation everywhere of soft parts are always as favorable as when it is transplanted into bony defects. However condi-

tions with reference to function are entirely different and these cause the transplant to behave in an entirely different manner. In both instances there is functional adaptation of the transplant to its surroundings. In the case of bone transplanted into a bony defect functional irritation results in *active hypertrophy* with subsequent union with the surrounding bone and transformation of the transplant. But bone transplanted into the *soft parts* has no function to perform. Functional irritation would consequently be reduced to a minimum and hypertrophic changes, although they may be present at first, are slight. Atrophy of disuse sets in and leads to a gradual diminution in size of the transplant. This in case of larger pieces of compact bone may progress very slowly so that the transplant may persist indefinitely as an encapsulated mass.

The transplant in this set of experiments was varied in composition as follows: bone plus periosteum, bone minus periosteum, bottled bone and periosteum alone. A segment of ulna varying in length from one-half to one inch was excised and that portion desired for transplantation was buried in the adductor muscles of the upper third of the thigh.

1. Bone plus periosteum and medullary contents.

There were five experiments in this series ranging in age from 9 to 84 days where the entire excised portion was transplanted.

9 day experiment No. 135 R. Transplant three-fourths inch long.

Direct on shows few gross changes. There is small amount of fibrous tissue in the ends of the medullary canal and hemorrhage in the rest of its extent. Periosteum unchanged except for small amount of spongy bony callus formation at one end. Most of the cells of the compacta have disappeared and others stain poorly while few are normal in appearance.

11 day experiment No. 133. Segment one-third inch long.

Soft parts have become loosely adherent to the transplant very little reaction about it. Ends of the canal filled in fibrous tissue. Periosteum on one side of one end stripped up for half centimeter. This surface is covered over by granulation tissue. Periosteum slightly thickened throughout most of its extent and there is thin layer of new bone

formed from the cambium layer in a few places. No ossification in the medullary callus of the ends. The marrow in the middle portion of the transplant is normal in appearance but contains some extravasated blood throughout. The cells of the cortex are, mostly, well preserved and some stain well but the majority stain poorly. Some of them have been absorbed.

33 day experiment. No 170 L. Transplant one inch long

The soft parts are thickened and adherent about it. The ends of the transplant are rounded off and covered by fibrous tissue. There is a layer of spongy new bone formed from the periosteum along most of its extent and a small amount bridging over the ends of the medullary cavity. There is also some new bone formation from the endosteum and about bony trabeculae in the medullary cavity. The cells of the compacta are practically all absorbed leaving the lacunae vacant. There has been considerable lacunar absorption of the dead cortex about the ends and some along the Haversian canals which are partly resorptacularized and dilated. There is a large amount of fibrous tissue in the medullary canal and some new marrow accompanying the newly formed bone.

Because of the marked reaction, the thick surrounding capsule, the absorption and rather large amount of excessively spongy new bone formed, I think there was a mild infection setting up a slight inflammatory reaction in the surviving portion of the transplant.

67 day experiment No 134 Transplant three-fourths inch long

Muscle loosely adherent about it. The ends of the transplant are rounded off and the medullary canals are closed over. The transplant is practically unchanged in size and is surrounded by thin, densely adherent fibrous covering. Macroscopical examination of longitudinal section shows bridges over the ends of the medullary cavity that consist of the incomplete layer of bony trabeculae covered by fibrous tissue and the periosteal surface of the transplant covered in most places by a layer of fibrous tissue with roughening and lacunae absorption along the surface. In other places there are trabeculae of new bone but they are few while the absorption has decreased the transplant size to slight extent. The cells of the compacta are all dead and absorbed and the Haversian canals are empty except the large ones which are filled by ingrowing fibrous tissue and blood vessels. The medullary cavity is filled largely by fibrous tissue and contains small amount of living marrow.

The striking features in this specimen are death of bone cells and beginning absorption

of the cortex. New bone formation is extremely small in amount being present at the ends where the endosteum has tried to bridge over the medullary canal as occurs in an amputation stump.

84 day experiment. No 135 L. Transplant three-fourths inch long.

It is surrounded by a thin fibrous covering the edges of the ends are rounded off and the ends of the medullary cavity are bridged over. Segment seems to be decreased in size particularly toward one end. Longitudinal section shows the bridges over the ends of the medullary canal that consist of a small amount of new bone about the walls of the canal covered over by an outer fibrous layer. The periosteal surface and ends of the cortex are covered by a thin fibrous layer which in most places has produced considerable absorption of the cortex but in two or three places there is a very thin layer consisting of one or two lamellae of new bone between this fibrous layer and the cortex. The old cortex is dead and all of its cells are absorbed. There are numerous dilated Haversian canals scattered throughout the cortex with a single circumferential layer of new bone formed in some of them.

In this series of experiments, periosteum has remained quite generally inactive, the bone-cells have died, and absorption of the dead cortex is taking place. Endosteum has formed only a small amount of new bone at the ends in an endeavor to close the ends of the canal. This seems to have been about the only stimulus for any new bone formation aside from the presence of an infection in Experiment No 170 L.

2 Bone minus periosteum transplanted into soft parts

52 day experiment No 160

Very similar in every way to 54 day experiment

54 day experiment No 130 Transplant one inch long

It is surrounded by a layer of fibrous tissue and the ends are somewhat rounded off and bridged over. There is no new bone formation along its periosteal surface but a small amount of absorption has taken place along almost the entire extent of the cortex. The cells of the compact bone are all dead and have been absorbed. The bridges over the ends consist of a small amount of new bone in their inner portions and fibrous tissue in their outer. The medullary cavity is filled partly from the ends is filled partly with dead marrow and fibrous tissue and partly with newly formed bone marrow. There is the layer of new bone consisting of only one or two lamellae along the endosteum at the ends of the

medullary canal. Some of the haversian canals of the cortex are dilated and in a few places circumferential lamellae of new bone have been formed.

94 day experiment. No 155 Transplant one inch long consisting of one half of a segment of the shaft split longitudinally.

It is somewhat diminished in size and pointed at one end. It is surrounded by a fibrous capsule with muscle firmly adherent and shows considerable absorption about the ends and pieces along its periosteal and endosteal surfaces. The cells of the old cortex are dead but the shrunken nuclei of many of them fill the lacunar spaces. There is no new bone formation along the surface of the transplant except for a small amount at the ends on the endosteal side and in some of the large superficial porous spaces and canals where layers of bone consisting of from one to three lamellae may be seen.

Death of bone-cells and absorption of the cortex are the predominating features in the specimen.

151 day experiment. No 137 R Transplant one half inch long.

Dissection shows it loosely adherent to the muscles and slightly decreased in size. The cells of the bony cortex are all dead and absorbed. The ends and edges of the transplant are rounded off and it is surrounded by a thin fibrous capsule. There is slight evidence of lacunar absorption in places along the periosteal surface and ends. While in other places there is a thin layer of one or two lamellae of new bone. There is some new bone along the endosteum toward the ends but no bony bridge over one end and only suggestion of one at the other. The medullary cavity is filled throughout with fibrous tissue. The larger haversian canals are filled with connective tissue and in a few places one or two concentric lamellae of new bone have formed in them. This specimen is encapsulated and absorption has been very slow. Only trace of bone proliferation is to be seen about the surfaces.

137 day experiment. No 137 L

Transplant one half inch long has diminished in size almost one half and is surrounded by a fibrous layer with muscles firmly attached. The edges of the ends are rounded off and the medullary cavity is bridged over by a very thin incomplete layer of bony trabeculae. There is a thin layer consisting of one or two lamellae of new bone along most of the extent of both the periosteal and endosteal surfaces and of the cut surfaces of the ends of the cortex. Evidence of lacunar absorption are not marked. The cells of the compact cortex are dead and have all been absorbed. There is revascularization of the haversian canals and in some of them one or two circumferential lamellae of new bone have been formed. The medullary cavity is filled largely by normal regenerated bone marrow and in the rest of its extent by fibrous tissue.

In this specimen there has been slight new bone formation bridging over the ends of the medullary canal and along the cortical and medullary surfaces, and to a slight extent within the haversian canals. There has also been some regeneration of bone-marrow in the medullary canal. However the retrogressive and absorptive changes are the striking ones, since the specimen had decreased in size about one half. It is possible that some of the new bone about the surface is heteroplastic in origin, having formed from the connective tissue capsule as in the case of the older specimens of boiled bone.

3 Boiled bone transplanted into soft parts.

10 day experiment. No 170 L

Transplant 1/8 of an inch long surrounded by granulation tissue. Cells of cortex all dead, and mostly absorbed. No new bone formation anywhere. Fibrous tissue growing into the medullary canal and large pores of the somewhat spongy cortex. There is some slight absorption about the surface of the transplant.

4 Periosteum free into soft parts.

I six experiment ranging age from 3 to 94 days. The periosteum removed from exposed segment of the ulna one inch long was transplanted into the adductor muscles of the thigh.

In the 3-day experiment the periosteum was alive and had proliferated, forming small masses of tissue resembling fibrous callus, but in none of the sections examined was there any new bone.

In three specimens, 35, 8 and 64 days old, there was a nodule of bone at the seat of implantation varying in size from a pinhead to a grain of wheat. In two specimens 42 and 90 days old no bone was present and the only remains of the implanted periosteum was small masses of scar tissue.

The fact that periosteum is removed from its bone and in a location where there is no demand for bone formation accounts for the entire absence of or inconsiderate amount of new bone formation in these experiments. This failure to form bone at least in any amount when in an abnormal location, is no proof of its inability to do so when in its normal place and when there is a demand for new bone formation.

52 day experiment. No 169 Transplant one-half inch long.

It is loosely adherent to the muscle and surrounded by a very thin layer of fibrous tissue. There is no appreciable decrease in size. Micro-



fluence of outside factors. Thus the occasional production of considerable bone by periosteum transplanted into the soft parts may be due to the presence of a blood-clot as in the thigh muscles, to the irritation of a mild infection as in Experiment No. 170 L, or to functional irritation in an abnormal location as may possibly be the case in Mc Williams' experiments where rib periosteum formed new bone when transplanted into the abdominal wall, the respiratory abdominal movements simulating conditions existing in the thoracic wall which result in the regeneration of ribs where subperiosteal resection has been performed.

My experiments in transplantation into the soft parts are entirely in disaccord with those of Axhausen. He claims that the living portions hypertrophied and that the compacta which dies is substituted by new bone. None of his experiments were sufficiently old for him to judge of these changes and to see that the transplant gradually decreased in size. He entirely disregarded Roux's law of functional adaptation and concluded that the transplant behaved about the same whether in the soft parts or in a bony defect. These experiments as well as those of Brown and Brown disprove these claims.

#### SUMMARY

1. Osteogenesis in bone repair occurs from the inner layer of the periosteum, from the endosteum and to a much less extent from bone cells and fibrous contents of the Haversian canals.

2. Viability of the cells of the transplant is dependent largely upon their ability to get nutrition and to some extent upon their degree of cell specialization. Periosteum and endosteum, being superficially located receive sufficient nutrition to survive and proliferate. The great mass of bone-cells being away from the surface and surrounded by an extensive and difficultly permeable calcified matrix gradually undergo necrosis and absorption. A few about the periphery and lining the larger vascular spaces as well as the fibrous elements of the latter may survive and proliferate. Blood-forming cells of the marrow despite their favorable nutrition and probably

because of their greater degree of specialization gradually undergo necrosis.

3. The subsequent changes which the transplant undergoes depend upon its composition and location. According to Roux's law of functional adaptation a transplant placed in a useful location i. e. a bony defect undergoes progressive changes while one in a useless location, i. e. soft parts, undergoes chiefly retrogressive changes and is gradually removed.

A Transplantation into a bony defect. Functional demand stimulates the surviving cells of the transplant to osteogenesis. Callus forms at either end which helps unite the transplant and the fragments. Creeping substitution of the dead cortex gradually occurs by the ingrowth of capillaries with dilatation of the Haversian and Volkmann's canals, absorption of the old bone, and deposition of new bone in its place.

(a) When periosteum and endosteum are left on, the transplant contains the greatest number of living osteogenic cells. Consequently union between the ends and substitution of the dead cortex occurs most constantly and rapidly.

(b) When periosteum is removed, osteogenesis producing union and substitution occurs from the endosteum and few surviving cells of the cortex, but the process is much slower than when periosteum is left on.

(c) When both periosteum and endosteum are removed, new bone formation from the few surviving cells is slight, and union with the ends of the fragments and substitution of the dead bone are very much delayed.

If such a transplant is cut into small pieces before implantation more cells survive because of the increase in surface and facilities for nutrition and greater functional irritation. Consequently considerable callus forms from each piece and, fusing with that from the others and from the ends of the shaft rapidly restores the continuity of the shaft. Ossification of the callus proceeds from the surface of each piece and substitution of the dead portions gradually occurs.

Axhausen's claim that osteogenesis does not occur from transplanted bone devoid of periosteum and endosteum is incorrect.

Equally erroneous is the old view of Barth now advocated by Murphy that there is no osteogenesis from any portion of a transplant, substitution occurring entirely by an ingrowth of new bone from the fragment ends.

(d) Periosteum transplanted into ulnar defects and in subperiosteal ulnar resections failed to regenerate bone and restore the shaft, but in subperiosteal resections with reimplantation of cortex either alive or after boiling it formed a layer of callus about the reimplanted portion. Subperiosteal resection of the humeral shaft in the young was followed by regeneration of the shaft.

Periosteum gets its chief impulse for osteogenesis not from an injury to itself but from the injured bone to which it is attached or intimately related and which demands repair.

#### B Transplantation into soft parts

The same portions survive as in a bony defect but since there is no functional demand for bone in this location little proliferation or substitution occurs and the transplant is gradually absorbed.

Transplanted periosteum produces little or no new bone for the same reason.

4. The presence of an infection, if severe results in death and failure of the transplant if mild there is set up in it an osteomyelitis with excessive proliferation and absorptive changes, but the transplant takes and is functionally a success.

5. A fracture through a transplant unites by callus formed from the surviving cells of the transplant in the vicinity of the fracture.

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## INTRAVENOUS ETHER ANÆSTHESIA

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THE intravenous administration of a narcotic for the purpose of general anesthesia has stood the test not only of numerous experiments on animals, but also of practical use in the treatment of human beings.

The same thing has been true of intravenous anesthesia as of everything else new in medical science. If it is unusual and apparently not altogether without danger it is taken up with reserve and submitted to a test only with great caution, at least in Germany. Only a relatively small number of surgeons have thoroughly tested this new method of general anesthesia proposed by Witzel and others and first successfully used by Burchardt on human beings and only a few have used it to any extent on their patients. Even in the textbook of surgery recently published by Bier, Braun and myself it is not mentioned.

This has led me to discuss this subject briefly before this scientific association of American surgeons and to recommend that the eminent surgeons of America test a method of anesthesia which gives excellent results in many cases if used for the proper indications and if the technique which is not difficult is properly carried out. In certain cases in my opinion, it is not excelled by any other method of general anesthesia. Though our method of inhalation anesthesia is so well developed that its dangers are slight, yet we often find patients requiring surgical treatment whose general condition is so bad that the inhalation method markedly increases the danger of operation and local anesthesia often does not produce complete insensibility to pain. For such cases intravenous anesthesia is a great gain.

The reason intravenous anesthesia has so slowly gained a place in surgery may be that there has been a fear of thrombus formation at the place of injection and of embolus proceeding from it. Kuttner observed 53 cases of pulmonary embolism which showed threatening symptoms and

cyanosis, and Clairmont and Denk of von Eiselsberg's clinic performed experiments on animals that seemed to show that intravenous anesthesia was uncertain and dangerous. These facts based on theoretical grounds have increased the fear of the dangers of this method of anesthesia.

The experiments we have thus far made with the intravenous administration of ether have been so unusually favorable that it seems to me desirable that it should come into general use.

We have used this method of anesthesia in 250 cases, which is, of course, a small number in comparison with the several thousand cases of general anesthesia we have in the course of each year. We entered upon our experiments with great caution, carefully selecting the cases and accurately testing the effect of the mixture of salt solution and ether on the general condition of the patient, on the kidneys, heart, lungs, and vessel walls. We were convinced in advance that this method would never supplant the scopolamine morphine ether or chloroform anesthesia, which we carry out with Roth Dräger's apparatus, but in the course of our experience we have become convinced that for certain groups of cases the intravenous anesthesia, by the method of its application and the stimulating effect on the organism, has superior results, and cannot be replaced by any other method.

Intravenous anesthesia is specially fitted for operations on the face and head, particularly in the mouth and pharynx, on the upper jaw and at the base of the skull (tumors of the hypophysis, etc.) as well as for operations on the neck. In such cases the anesthesia is in the way of the operator. Anesthesia is often incomplete because of the necessity of frequently putting on and taking off the mask which is in the way of the operator. This is completely aided by intravenous anesthesia. There are great advantages in a uniform, quiet anesthesia, which is conducted far away from the field of opera-

tion, which enables us unhindered to carry out operations on the face, mouth, etc., and which at the same time increases the strength of the patient by the constant influx of salt solution in operations where there is a great loss of blood.

The method has turned out surprisingly well in 30 cases of tumors of the upper jaw of the larynx, thyroid, base of the brain and skull, carcinoma of the tongue and tonsil, plastic operations on the nose, etc. because it has given a uniform, quiet anesthesia that did not interfere with the field of operation or disturb the operator and his assistants.

Moreover the intravenous ether anesthesia had advantages in the case of patients who were weak or who from the long duration of their disease, were much exhausted and emaciated. These are the patients to whom we often have to give an infusion of salt solution at the beginning of the anesthesia in order to increase their strength to a certain degree and make the giving of general anesthesia possible. When, with patients in such poor condition, we are placed in a position to add to the salt solution entering their veins another stimulant that not only increases the effect of the solution, but at the same time anesthetizes the patient without danger this seems to me to be the ideal method of anesthesia for this group of patients.

Such patients often leave the operating room after the operation with a much stronger pulse, often with remarkably good heart action and with a fresher appearance than when they came in. They awake from the anesthesia quickly and without any unpleasantness. We have never observed nausea and vomiting after intravenous ether anesthesia, a factor that is not to be disregarded in weak patients after laparotomies. The comparatively better condition after this form of anesthesia is readily explained by the smaller amount of ether.

Intravenous anesthesia was used in 100 cases of carcinoma of the esophagus and cardia, in malignant tumors of the stomach, benign stenosis of the pylorus, in 12 tumors of the rectum and cæcum, in total extirpation of the carcinomatous uterus, in extra-uterine

pregnancy in malignant tumors of the abdominal cavity in kidney diseases, diffuse peritonitis, in patients with fungus of the knee joint, and with tumors of the thigh.

As to the important question of the dangers of intravenous anesthesia, I believe that they have been greatly exaggerated from theoretical considerations. It was assumed in advance not only that there would always be a thrombus formed at the site of injection, but that embolism would frequently result. These assumptions are of course, justified, and caused us to proceed with the greatest caution in the carrying out of this new method of anesthesia. The formation of thrombus would be the weakest point in intravenous anesthesia if it were to be feared that emboli would often result from it.

What are the actual facts in the experiments thus far with regard to the formation of thrombi and embolism following it? Like Burchhardt we have never had a case of pulmonary embolism among our patients anesthetized intravenously but in the early days of its use we frequently had local thromboses at the site of injection into the vein. In three cases there were complaints soon after the operation of pain in the region of the injection, which stopped after a few days. The thickened vein could be felt for a distance of 3 to 5 cm. We have never observed such symptoms in other cases.

As we were dealing almost exclusively with patients in very poor condition, many of them suffering from advanced carcinoma, and succumbing to the disease sooner or later after operation, in many of the cases we had the opportunity of controlling the clinical observation by autopsy. The lungs, heart, and kidneys showed no special pathological findings, at least none that could be attributed to the anesthesia, but in the first cases that came to autopsy there was thrombosis at the site of injection. In those cases where the ether-salt solution had been allowed to enter the veins as needed and the stream was interrupted from time to time, there were tolerably thick, hard thrombi, partially stopping the collateral vessels. In the other cases the thrombi were shorter and softer and not more pronounced than those that

exceptionally follow the injection of simple salt solution and frequently follow the injection of digalin or adrenalin.

In a later group of intravenous anesthetics in which we used the improved method of a continuous stream of physiological salt solution and were able to observe the effect several times at autopsy we did not see a single case of thrombosis.

It seems to me that the danger of the consequences of thrombus formation at the site of injection is exaggerated. Since we have given greater attention to the effect of simple salt solutions especially those containing adrenalin and digalin we find that there is almost always the formation of a thrombus in the use of solutions with a medicinal content, but that pulmonary embolism never results from them. The appearance of an embolus originating from a thrombus of the upper extremity seems to be an unusual occurrence. Certainly our present method of giving medicines intravenously would be decidedly limited if there were any danger worth mentioning of embolism resulting from it. If there was any reason to fear the formation of these slight thrombi in the veins of the upper arm we would have to give up the frequent administration of salt solution containing digalin or adrenalin which is, of course regarded as being without danger. Certainly no one contemplates giving up this valuable addition to our methods of treatment and no one has had any cause to do so by any injury experienced.

The same thing is true of the dangers arising from the addition of ether to the solution they are slight, even though the ether like digalin or adrenalin, is a substance that injures the vessel walls to a certain extent. When we have succeeded by further perfection of the technique in reducing thrombus formation to a minimum or even overcoming it completely this new method of anesthesia will be freed still more from the dangers attending it.

As to the value of the intravenous administration of salt solution as such to the organism we are ardent supporters of this therapeutic measure which has saved so many human lives. We use it in large quantities and

a great number of times, so that when necessary we have given as much as 18 liters with in 24 hours without danger to the patient, on the contrary it has saved life. We interrupt the giving of salt solution and also the intravenous anesthesia, when edema of the lower eyelids and the sclerotic conjunctiva occurs. The amount of solution to be injected is an important point in intravenous anesthesia, and naturally it varies with the strength of the individual. In a weak, dried-out body that eagerly absorbs water we can give relatively large quantities of fluid, but we reach the limit much quicker in a strong patient with a well filled vascular system.

As to the indications for intravenous anesthesia they are, as I have said thin and weak individuals (carcinoma ulcer of the stomach, etc.) those who have undergone hemorrhage (extra uterine pregnancy ischuria, etc.) as well as collapsed patients (peritonitis etc.) Furthermore, it should be used in operations on the neck and head (throat, tongue, etc.) and I believe it will meet with greater success than any other known method of anesthesia.

In very strong individuals the inhalation method should be given the preference or when the above mentioned indications, head and neck operations, make it seem desirable the salt solution containing the ether should be allowed to flow into the veins very slowly and with the greatest caution and it should be combined with isopral.

Intravenous anesthesia is contra-indicated in arteriosclerosis, in which there is generally a high blood pressure in severe myocarditis and in general plethora.

We have never observed complications in the heart and lungs, except in one case where there was a pulmonary and laryngeal tuberculosis, which seemed to be made worse by the intravenous anesthesia. In amyloid disease of the kidney the albumin excretion was slightly increased the first few days after the operation in the other cases the urine remained free from albumin, blood, and kidney constituents.

In a great number of the cases, immediately after the operation blood was withdrawn from the vein of the arm of the opposite

side. Neither microscopically nor spectroscopically could any changes be demonstrated in the red blood-cells in their color or hæmoglobin content. This is due to the fact that the 5 per cent ether solution does not attain its full effect as only 4 per cent of the ether mixes with the water and a part of it escapes from the open vessel containing the solution. If this is covered it collects over the water. This can also be demonstrated by holding a lighted match over the vessel, when the ether will burn with a bluish flame. Not more than a three and one half per cent ether solution flows into the vein. Moreover the greater part of the ether given is excreted again directly through the lungs as can be demonstrated by the odor of the expired air soon after the beginning of the anaesthesia. Even on observing the patients for a long time during convalescence nothing was ever found which indicated an injurious effect of the intravenous anaesthesia.

This form of anaesthesia is very pleasant for the patient. Headache, vomiting or other disagreeable after effects were never observed. In many cases the patients themselves asked to be anaesthetized through the arm because they had heard from their neighbors in the ward the pleasant effects of this method. In seven cases intravenous anaesthesia was given patients a second time at their own request when another operation had to be performed.

Tolerance and practice is of great value in the technique of administering intravenous anaesthesia as it is in lumbar anaesthesia. All of our patients from about the 20th to the 63d year are given before the operation the usual dose (3 to 5 decimilligr.) scopolamine and 1 centigr. morphine whether inhalation anaesthesia or some other method is to be used. In twilight keep the patient's eyes are covered on the operating table and with the usual antiseptic precaution the median vein is bared and the cannula inserted as in the giving of salt solution. In order to avoid the formation of thrombi we do not interrupt the stream of solution. Two glass vessels are placed on a standard one containing 4 per cent ether solution the physiological salt solution of 41 per cent strength

The tubes from both of these vessels are united in a Y shaped glass tube which has on its lower limb a piece of rubber tubing carrying the cannula and a stop-cock that is easy to regulate. By means of the latter it is possible to give a uniform injection of small quantities of fluid. For instance after a sufficient amount of the ether solution has been given to induce anaesthesia the ether solution is shut off by means of a clamp while the physiological salt solution is allowed to flow slowly until the return of the reflexes indicates that more ether is needed. Then the salt solution tube is closed and the ether tube opened.

This arrangement makes it possible to give accurate dosage because the amount of solution used can be read from the graduated glass vessels and by means of the stop-cock the rapidity of the flow into the vein can be accurately regulated. The regulation is most suitably and easily accomplished by means of a suitable bored glass stop-cock.

The stage of tolerance which permits the operation to be begun generally sets in after ten minutes in very weak patients often after four or five minutes when 100 to 300 grammes of fluid corresponding to 4 to 15 grammes ether has been given. In some cases this takes place after one and one half to two minutes. Aside from slight movements of resistance we seldom saw any stage of excitement. Only in one case that of a 25 year old man who had been anaesthetized often the severity of the stage of excitement made it impossible to continue the intravenous anaesthesia. In three other cases of very excitable men or drinkers a small amount of chloroform was given and then the intravenous anaesthesia continued without interruption.

At the beginning of our experiment before we began to give the continuous injection we had slight cyanosis twice and once asphyxia which demanded artificial respiration. Probably from lack of experience too much ether was given in a unit of time. The cyanosis stopped immediately after the ether solution was cut off. I mention this especially in opposition to Dumont's opinion that in intravenous an

anesthesia the administration of the anesthetic should be stopped at once with the appearance of the slightest symptom of danger—not less quickly but perhaps even more quickly than in inhalation anesthesia.

Almost without exception the anesthesia proceeded very quietly, the breathing was uniformly good, the pulse stronger because of the giving of the solution. We had no accidents aside from the insignificant disturbances mentioned.

The longest duration of an intravenous anesthesia was in a man in extremely poor condition with a carcinoma of the cardia besides an extensive resection of the stomach. It was necessary to remove the cardia and 10 cm of the esophagus. Within 140 minutes 1700 ccm of the ether solution, or 85 gm of ether were given. I believe that the favorable course of this extensive operation and the recovery after resection of the carcinomatous cardia was due to the stimulating effect of the intravenous anesthesia. In another patient, from whom a tumor of the base of the brain was removed by temporary resection of the upper jaw we used in 105 minutes only 900 ccm of the ether solution or 45 gm ether. In an operation for a ruptured aneurism of the abdominal aorta, which was sutured and required one and one-half hours, we used about 60 gms ether. In one case 3700 gms of fluid was given the patient recovered.

In order to hasten the beginning of anesthesia, especially in drinkers and strong individuals, we have combined the ether for intravenous administration with other narcotics. Of the different ones used veronal, hedonal and isopral, we prefer the latter first used and recommended by Burchardt because it seems to have fewer injurious effects. Intravenous hedonal anesthesia, which has been chiefly used by Fedoroff and other Russian surgeons, seems to me to be not entirely without danger for the respiratory center, heart, and kidneys and experiments by Beresnegowsky in Tomsk show that even in pure isopral anesthesia there were injurious effects on the heart, liver and kidneys.

I would not recommend an intravenous

anesthesia of pure isopral, as this agent when used abundantly and for a long time causes a marked lowering of the blood pressure and seems to have an injurious effect on the respiratory center but the use of a one to one and one-half per cent isopral solution, to begin and hasten intravenous ether anesthesia has given good results and when carefully and correctly used has no disadvantages.

Since October 1912 we have used this combined method exclusively and have tried it in 80 cases. A third glass cylinder is added according to Burchardt's directions, which is filled with sterilized isopral solution. The isopral is used in a concentration of one to one and one-half per cent in Ringer's solution. About 24 hours are necessary for the solution as it can only be heated to 30 degrees. Slow administration of the isopral solution, not more than 100 gms in five minutes, is important. If it is given too quickly or in too great quantities, apnoea or cyanosis may occur which disappear as soon as the flow of the solution is stopped. In only one case of inoperable carcinoma of the stomach, with dissemination in the peritoneum in a patient in very poor condition, the respiration stopped while the pulse was strong and full artificial respiration had to be performed for a short time. This was caused by giving the isopral solution too quickly. In most cases 80 gms of isopral solution was sufficient to induce the stage of tolerance in three to five minutes. More than 150 gms of the solution, containing one and one-half to two and one-fourth gm isopral is not to be recommended. After the beginning of anesthesia, by simply turning the valve-cock, the anesthesia is continued with ether. In weak patients the ether anesthesia alone is sufficient.

We believe from our experience that intravenous ether anesthesia is a form of anesthesia which, when given for the proper indications, is not excelled by any other form of anesthesia in a large group of cases. I might even say that for many cases it is the ideal anesthetic, for besides the fact that such a small amount of the anesthetic is

necessary. It has an active, stimulating effect, which cannot be said of any other form of anesthesia known.

The addition of a one to one and one half per cent solution of Isopral is an excellent supplement in the induction of intravenous ether anesthesia, because it brings about the

stage of tolerance more quickly especially in drinkers and patients who are hard to anesthetize. Too quick an injection of the solution, or too great doses, may cause a fall in the blood pressure, or cyanosis. We have never yet seen any ill effects from the intravenous Isopral-ether anesthesia.

## THE RESULTS OF OPERATION (LARYNGOFISSURE) FOR INTRINSIC CANCER OF THE LARYNX

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THE surgical treatment of intralaryngeal cancer gives exceedingly good results, especially when compared with those obtained by surgical treatment of cancer in other internal organs.

On examining the facts we find this to be due to the peculiar manner in which intrinsic cancer of the larynx originates, develops and spreads, as was originally pointed out by my friend Sir Felix Semon. It would be interesting historically to consider the development of the pathology, diagnosis and treatment of intrinsic cancer of the larynx, but lack of time forbids me doing so. You must, however, permit me to state here in London, speaking to an assembly of prominent American and English surgeons, that in my opinion the whole of our present knowledge of the diagnosis and treatment of this disease is founded on the works of Semon and Butlin, who towards the end of the last century entirely revolutionized our views with regard to the malignancy of intralaryngeal cancer. Before their day the surgical treatment of this disease had always been regarded as almost hopeless, but Semon showed us that the chief reason for this was that the disease was always diagnosed too late and therefore too far advanced to give any good operative result.

Having further learned that intralaryngeal cancer in the great majority of cases appears as a primary cancer of the vocal cord, and therefore soon causes hoarseness, we have means of recognizing the disease at an early stage of its development, while still limited

to the vocal cord, and so of a probable radical cure by removing the diseased vocal cord through a laryngofissure.

To illustrate the frequency of primary cancer of the vocal cord I wish to draw your attention to this table of sixty-six cases of intralaryngeal cancer which have come under my observation.

TABLE A. PRIMARY SEAT OF INTRALARYNGEAL CANCER

Unspecified localization	18	27 Cases
Vocal cord	20	34 Cases
Subglottis	20	34 Cases
Epiglottis	20	34 Cases
Glottis	20	34 Cases
Subglottic band	20	34 Cases
	66	Cases

In the first eighteen cases the primary seat of the disease could not be localized, as the tumor had extended too far into the larynx when first observed.

The table clearly shows that cancer of the interior of the larynx, in by far the majority of cases, originates as a growth of one vocal cord generally in the central part of it, and that it can therefore be radically removed. If however the disease has extended to the anterior commissure the prognosis becomes more serious, as under these circumstances the thyrotomy cuts through the growth and may possibly be followed by a recurrence.

Those cancers of the larynx which do not primarily attack the vocal cords have on the contrary a bad prognosis, first, because they very often are not discovered until they have spread so far that there is no possibility of a

radical cure by means of a laryngoscope secondly because these extracordal cancer are generally of a more soft medullary character growing quickly and with greater tendency to involvement of the neighboring lymphatic glands.

The only exceptions to this are the pedunculated adenocarcinoma which spring from the aryteno epiglottic fold. Of these I have seen three cases which had a relatively good prognosis and could be treated endolaryngeally with favorable results.

Having made the diagnosis by means of laryngoscopic inspection supported by microscopic examination of a portion removed through the mouth the growth could be removed as soon as possible by means of a laryngoscope.

The operation should be performed as indicated by Butlin and Simon who about 1900 inaugurated this treatment and proved that this comparatively safe operation was sufficient if performed soon enough.

I myself following their instructions briefly operate in the following manner.

The operation is always performed under general anesthesia. I begin with morphium either and make a low tracheotomy. Halsted tampon-cannula is introduced and the ear-coil continued with chloral form. The thyroid cartilage having been divided and the interior of the larynx opened I fill the pharynx with sterilized gauze introduced from below through the split larynx in order to prevent the saliva from descending and interfering with the scene of action. According to Simon, the larynx is packed with gauze soaked in a 10-per-cent solution of cocaine to which I add a few drops of a 1 per cent solution of adrenalin in order to anesthetize the mucous membrane of the larynx and make it bloodless. Then the neoplasm together with the whole diseased vocal cord is removed by means of knife and cauter.

All the diseased area having been removed and the bleeding stopped we formerly filled the larynx with a tampon of iodoform gauze but since Butlin has taught us to give up tamponading and to close the thyrotomy wound at once the results of operation have been much better.

The patients are now able to swallow on the day of operation and can leave their beds a few days later. This of course is of the greatest importance in preventing complications in the lung especially in elderly people. My two oldest patients respectively 1 and 4 year old were able to leave their bed on the second day and they are both alive and well now at the age of 50 and 46 years.

Thyroidectomy only be performed in thirty three of my cases treated up to 1912, as shown in the following table (Table B).

TABLE B. RESULTS IN 30 CASES OF CANCER OF LARYNX

EXTENT OF DISEASE		TREATMENT	
		Cured	Not Cured
No tracheotomy	10		
Tracheotomy	20		
Thyroidectomy			
Not performed	10		
Performed	10		
Total	30	10	20

The results of these thirty three thyrotomies was that twenty-eight patients cured of the operation while one died from pneumonia due to the post-operative hemorrhage.

Of the twenty-eight patients operated upon, recurrence took place in ten cases, while eighteen are alive and well. These eighteen had the carcinoma entirely limited to the vocal cord and the diagnosis was made at an early period of the disease with only two exceptions. The first of these was a man aged 44 years (see Table D No 11) who had a cancer of the posterior wall of the larynx, and whom I was able to follow for three years after the operation, when I lost sight of him. The second was a man, aged 53, suffering from an epithelioma of the left ventricular band, anterior commissure and the anterior part of the right ventricular band. This patient I operated on fourteen years ago since which time he has been on an expedition to the North Pole and is still alive and well.

The last four patients were operated in 1912 and have therefore been under observation only about two months. But they were all cured after the operation.

— E. M. Ed.

epithelioma of the vocal cord and were operated so early that there is not much chance of recurrence.

Patient No. 7 a man aged 61 was operated in 1905 for a cancer of the vocal cord. During the following seven years his larynx remained perfectly healthy but he now has a quickly growing cancer in the throat requiring tracheotomy. Ought this to be considered as a recurrence or as an accidental cancerous infection of a larynx which has kept perfectly healthy for seven years after operation? Personally I am inclined to look upon it as an accidental reinfection. In all the other cases of recurrence this took place within a year after the thyrotomy.

The functional result was exceedingly good in all cases. The voice was strong generally sonorous, but in a few cases hoarse. The man aged 71 was operated on in 1905. I saw him last in 1913. He was then 79 years old and had a strong healthy voice.

A clergyman aged 55 who was operated in 1896 fulfilled his duties for eight years and preached every Sunday in two churches.

The two men, aged respectively 66 and 67 years, who were operated in 1911 are able to make speeches to large assemblies with a comparatively clear voice.

So as to get a broader basis of judgment as to the results of thyrotomy in cases of intrinsic cancer of the larynx I have combined in the following table my own experiences and those of F. Semon Chauri and St. Clair Thomson. The results are as follows:

TABLE C. RESULTS OF OPERATION BY LARYNGOFISSURE

	Cases	Cure over five years	10 years	Under year	Recur traces	Death from other cause
Semon Chauri	81	5			3	
Chauri	89		7			
St. Clair Thomson	11		1			
	96	45	17		15	

Secondary operation for removal of larynx, above five years later

I now will see from this table that of 96 operated patients 52 (63 1/2 per cent) were cured for more than one year after the operation.

TABLE D

Table of eighteen cases of intrinsic cancer of the larynx, thyrotomized without recurrence

Age	Sex	Date of op.	Time of survival	Annotations
61	M	1893	8 yrs	Dead of cancer rectum. Larynx free
66	M	1900	7 yrs	Alive no recurrence
67	M	1901	7 yrs	Alive no recurrence
68	M	1901	7 yrs	Alive no recurrence
69	M	1901	7 yrs	Alive no recurrence
71	M	1905	8 yrs	Dead of cancer of stomach no recur trace in larynx
71	M	1905	8 yrs	Alive
71	M	1905	7 yrs	Alive no recurrence
71	M	1905	7 yrs	Dead of tuberculosis larynx free
71	M	1905	7 yrs	Alive no recurrence
71	M	1905	7 yrs	Last sight of
71	M	1905	7 yrs	Alive no recurrence
71	M	1905	14 yrs	No recurrence dead of some other disease
71	M	1905	7 yrs	Alive no recurrence
71	M	1905	7 yrs	Alive no recurrence
71	M	1905	7 yrs	Alive no recurrence

Seven years after the operation cancer recurred in the larynx, probably new infection

TYPHOID PERFORATION<sup>1</sup>

By GEORGE E. ARMISTONG, M.D. MONTREAL, QUEBEC

**I**N the two provinces of Quebec and Ontario in Canada there were during the five years 1908 to 1912 inclusive 6,011 deaths from typhoid fever an average of 1,202 deaths per annum.

In the province of Alberta during the five years 1909 to 1913 inclusive there were 852 deaths from typhoid fever an average of 170 per annum.

In the United States of America during the four years 1909 to 1912 inclusive there were 45,833 deaths from typhoid fever an average of 11,458 deaths per annum. The average death rate was a little over 20 per 100,000 of population.

The responsibility for this enormous waste of human lives cannot be laid at the door of the medical profession. It is a reflection upon the humanitarianism and business acumen of the laity in these countries. Those who succumb to typhoid are among the most promising in the country. The greatest susceptibility is from fifteen to twenty five years of age. It has again and again been proved to demonstration that pure water and efficient drainage prevent typhoid. Typhoid can be arrested by an act of Parliament and by municipal legislation. Regarded as a purely economic question the money spent in removing the cause of typhoid would earn larger dividends than if invested in the best bonds in the world. Why should not municipalities, towns and cities be made as responsible financially for the loss of time and loss of life from a preventable disease like typhoid as are the transportation companies by land and water made responsible for preventable accidents.

Typhoid is still with us however and it is still attended by a mortality from several complications, 75 per cent of which are surgical. It is to one of the most important of the latter that I would ask your attention. One cannot approach the subject of surgical complications of typhoid without an appreciation of the influence of W. W. Keen, who brought this subject so clearly

before the profession in his book published in 1898.

The incidence of perforation varies in different years and in different epidemics. In Germany perforation is less common than in America. Recent figures embracing 9,713 cases collected in England, Canada, and the United States show that more than one third of the deaths from typhoid are due to perforation. At the Johns Hopkins Hospital there were 43 perforations in 1,300 cases or 1 in 35. In the Pennsylvania Hospital there were 50 perforations in 1,948 cases, or 1 in 39. In the Royal Victoria Hospital Montreal there were 83 intestinal perforations in 2,917 cases, or 1 in 35 and two perforations of the gall bladder. In the Montreal General Hospital there were 110 perforations in 2,494 cases or 1 in 22½ cases. In the Royal Victoria and Montreal General hospitals it is sometimes quite impossible to admit all the cases of typhoid that apply. Only the severer cases are taken in. Again quite a number of cases are admitted after perforation has occurred.

In 15,324 collected cases there were 544 perforations, or about 1 in 31½.

Statistics show perforation to be more common in men than in women. The reason is not obvious. Perforation in children is rarer than in adults.

*Pathogenesis.* Chomel remarks that the accident is sometimes the result of ulceration, sometimes of a true eschar and sometimes it is produced by the distention of the intestine, causing the rupture of the tissue weakened by disease. In a specimen in the McGill Museum there are 10 perforations in the ascending colon and sigmoid, probably from distention. I have usually found the perforation near the base of a generally well defined ulcer. In size it varies from a very small pin-point hole to an opening the size of a lead pencil. Only rarely is it larger. It is always situated almost directly opposite the mesenteric attachment.

While it is true that the perforation may

occur at any point in the stomach, in the small or large intestine or in the appendix vermiformis, yet, fortunately for the patient and the surgeon, it is found somewhere in the terminal two feet of the ileum in an overwhelming majority of cases.

**Prognosis** That a typhoid perforation not closed by the surgeon is always a fatal complication is, as a rule, a true statement. The only exceptions are those in which a perforation of the large bowel occurs between the layers of its mesenteric attachment. When this occurs an abscess develops, extra peritoneally which may subsequently be opened. In the single case in my series in which this occurred, the fistula gradually healed. It is probable that all cases in which a perforation of the small intestine occurs into the peritoneal cavity prove fatal, unless recognized and the opening closed. The duration of life after perforation in 134 cases collected by Ilitz was as follows:

Died on the first day	37 3 per cent
Died on the second day	29 5 per cent
Died in the first week	83 4 per cent
Died in the second week	9 cases
Died in the third week	4 cases
Died in thirty days	case
Died in thirty-eight days	case

**Diagnosis** It is easy to establish the fact that a considerable percentage of the mortality in typhoid is due to perforation of the intestine, and also that a goodly number of these cases may be saved by early recognition and closure of the lesion. The great difficulty is the diagnosis. To get the best results the accident must be recognized early and appropriate treatment instituted promptly. Here is the great difficulty—the question of early diagnosis. Some of our standard textbooks are misleading in their remarks on the diagnosis of typhoid perforation. If it will not be considered too presumptuous for a Colonial to criticize writers in the great educational centers of Great Britain, I would like to say that when a recent edition of Choyce's Surgery says that the symptoms suggesting perforation are the sudden onset of acute pain referred to the umbilicus, or to the right lower half of the abdomen, with muscular rigidity and tenderness on pressure most marked in the right lower quadrant of

the abdomen and that there is nausea and vomiting and other symptoms of acute infection and when Howard in his Practice of Surgery issued this year says the symptoms of typhoid perforation are sudden, acute abdominal pain, with collapse and fall in the temperature—they fail to appreciate the difficulties that surround the question of the diagnosis of typhoid perforation. The occurrence of perforation is but seldom indicated by such well marked striking symptoms. Furthermore a fatal peritonitis may develop in typhoid without any perforation discoverable at autopsy as reported in the Munich autopsies and in various medical journals.

The first indication that a perforation has occurred is usually pain. It was present in 75 per cent of this series of 83 cases and absent in 25 per cent. Seventy five per cent of them had either sudden crampy pain or sudden persistent pain in the following regions (mentioned in order of frequency): generalized right lower quadrant umbilical zone left lower quadrant epigastrium and left hyperchondrium. In 25 per cent of these cases the pain was generalized or in the right or left lower quadrants. Often the pain will not be severe enough to impress upon the nurse the need of sending for the doctor unless she has been specially trained in a typhoid ward. An important point in the training of a typhoid nurse is to teach her to send for the intern whenever a typhoid patient complains of abdominal pain.

In 25 per cent of cases not having pain at onset, the following conditions were found:

In 1 per cent toxæmia obscured all signs
In 4 per cent the condition was obscured by severe concurrent hemorrhage
4 per cent were not diagnosed.
per cent had chills
per cent had rapidly
4 per cent had vomiting

In regard to time, 61 per cent occurred at night and 38 per cent in the daytime. Four per cent of the cases had definite profuse sweats immediately after the perforation.

The symptom that I would place second because of its constancy and significance, is change of expression. The change of appearance in a majority of the cases was quite evi-

dent. Sixty-five per cent showed a very definite alteration 18 per cent a gradual change and 7 per cent no change. This change in appearance was manifested in a picture of suffering from pain a sudden pallor a change from a feeling of comfort to that of distress, a restlessness, cardiac failure, vomiting painful defecation, loss of rallying power after hemorrhage a chill, profuse sweat, general *malaise* an unaccountable change in general condition for the worse or sometimes a feeling among those in attendance that something had happened that they could not account for.

Tenderness was present in some degree in 88 per cent of the cases and absent in 12 per cent of the cases.

In 50 per cent of the cases it was generalized.  
In 50 per cent of the cases it was limited to the lower abdomen.

In 5 per cent of the cases it was limited to the right lower quadrant.

In 5 per cent of the cases it was limited to the left lower quadrant.

In 1 per cent of the cases it was limited to the right upper quadrant.

In 1 per cent of the cases it was limited to the left upper quadrant.

In 1 per cent of the cases it was limited to the upper abdomen.

In 1 per cent of the cases it was limited to the umbilical zone.

As for time of appearance —

In 50 per cent of the cases it came with pain at the onset.

In 50 per cent of the cases it came within the first hour.

In 6 per cent of the cases it came within the second hour.

In 3 per cent of the cases it came within the fourth hour.

In 1 per cent of the cases it came within the eighth hour.

In 1 per cent of the cases it came within the tenth hour.

In 1 per cent of the cases it came within the twelfth hour.

In 1 per cent of the cases it came within the twenty-fourth hour.

In some cases tenderness is definite from pushing forward the anterior wall of the rectum with the examining finger.

#### RIGIDITY IN TYPHOID PERFORATION

85 per cent of the cases showed distinct rigidity.  
5 per cent of the cases did not.

Of this 85 per cent showing rigidity —

44 per cent showed it from onset of trouble.

1 per cent showed it within the first hour.

8 per cent showed it within the second hour.

4 per cent showed it within the third hour.

6 per cent showed it within the fourth hour.

6 per cent showed it within the sixth hour.

8 per cent showed it within the twenty-fourth hour.

1 per cent showed it within the twenty-second hour.

#### Location

50 per cent showed generalized rigidity.

1 per cent showed rigidity of the right lower quadrant.

28 per cent showed rigidity of lower half of abdomen.

8 per cent showed rigidity of right upper abdomen.

5 per cent showed rigidity of left upper abdomen.

4 per cent showed rigidity of left lower abdomen.

In a very few instances the term *reant* once would more correctly designate the condition present.

Little or no value can be attached to the absence of liver dullness. If the area of liver dullness has been noted from day to day and then suddenly disappears in association with abdominal pain it is significant. It is valueless in a distended abdomen. It was obliterated in 45 per cent, not changed in 16 per cent, and not mentioned in 39 per cent.

The fall in temperature so often spoken of rarely occurred. Occasionally there was a fall of one or two degrees in six or eight hours but only in a few cases did any spectacular drop such as from 103 to normal, take place. In one case the temperature rose from normal to 104 in two hours.

The pulse changes were always clear. A rapid change from slow and good volume to rapid and small often occurred. In 95 per cent of the cases the pulse quickened. Of the change in blood pressure I cannot speak.

Those who have seen many typhoid perforations will appreciate Fitz's statement that perforation of the intestine in typhoid fever may take place without any suggestive symptoms, and that suggestive — even so called characteristic — symptoms may occur without any perforation having taken place.

In the textbook perforations, diagnosis is easy but if we are to save a large percentage of these unfortunate patients we must detect the accident in its most insidious form.

Again, it is not necessarily a reflection on diagnostic skill and sound judgment when the abdomen is opened after careful consideration of the symptoms present by two or three clinicians and no perforation is found. It would seem that this may happen occasionally if a conscientious attempt is made to recognize perforation as soon as it occurs. One case is on record in which the abdomen was opened twice in the same patient without finding any perforation. The same abdomen was later

opened a third time the perforation found and the patient's life saved. We cannot always afford to wait in these cases until the diagnosis is absolutely definite and assured.

What symptoms call for immediate abdominal incision or rather what are the minimum of signs that may demand surgical intervention? Pain, persistent definite change for the worse in the expression of the patient, tenderness either abdominal or rectal rounding up of the abdomen and increased resistance to pressure. If these symptoms are present, even if the temperature and pulse are not decidedly altered nor vomiting present, the likelihood of a perforation is very great.

Local anesthesia has very materially altered our attitude toward early operations. It is no longer necessary to administer a general anesthetic. The abdomen can be quite well opened under local anesthesia without causing the patient any pain whatever. The closing of a typhoid perforation is one of the simplest operations in surgery, one that can quite well be performed by anyone capable of carrying out a perfect surgical technique. A one per-cent solution of novocaine with the addition of two drops of adrenalin to the dram is thoroughly satisfactory and may be used freely. Inject first the skin and subcutaneous tissue and then with a needle one inch long penetrate the deeper muscular layers along the line of incision. Either a gridiron incision or one along the outer border of the right rectus answers admirably. The perforation is nearly always found in the terminal twelve or twenty-four inches of the ileum. It is very easily found. A couple of through and through sutures usually suffice to close the opening and then one or two rows of fine Lambert sutures complete the operation on the intestine. One should always look for a second or possibly a third perforation. These are seldom found, but not uncommonly some of the ulcers in the neighboring portion of the ileum will present a very thin necrotic looking base. It is a good practice to infold such with a single row of Lambert sutures as a precaution against

further perforation occurring after the abdomen is closed. Resection of an ulcerated portion of intestine in typhoid is rarely indicated and should be reserved for the skilled operator and for unusually threatening conditions.

When the abdomen is opened perforation is generally made clear by the presence of fluid or lymph or by the escape of a little gas. Should none of these evidences be observed do not close the abdomen without examining at least the terminal two feet of the ileum. It may be that a small pin-head perforation is temporarily closed by a tag of omentum. I have found this condition present in three of my cases. Of course such cases give a most favorable prognosis.

The percentage of recoveries is gradually increasing. Von Layden, in 1884, suggested that the only rational way of treating perforations of the stomach and intestines was surgical. In the same year Miculicz closed a typhoid perforation. The patient, a man 40 years of age recovered. Fourteen years later Keen collected 83 cases with a recovery percentage of 19.36. In the Royal Victoria and Montreal General hospitals 140 perforations have been closed and 38 have recovered or 27.14 per cent. These figures include the work of all the surgeons attached to the hospitals. The figures are not large but I think they represent 38 lives saved. The other cases of perforation were not operated upon, chiefly for three reasons: viz. not diagnosed, desperate conditions that offered no chance of success and refusal of patients, parents, or guardian to allow operation.

It is sometimes very discouraging. My first six cases died and then I was about ready to give it up. I succeeded in saving my seventh case and from that time recoveries have occurred more and more frequently. From January 1909 to June 1914 I closed 22 typhoid perforations and 11 recovered or 50 per cent. An important point is to let the house staff feel that it is a reflection on their professional attainments to overlook a perforation. When once they really appreciate that fact cases are sent to the operating room promptly.

## THE SUTURE OF THE LEVATOR ANI MUSCLE IN PERINEORRHAPHY OPERATIONS

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THE selection of a subject which is suitable for discussion before this Congress is a matter of some difficulty since matters which are of the highest interest and importance to the gynecological surgeon are not so necessarily to the general surgeon. At the same time, it is more likely that a specialist will be of interest to his hearers if he deals with a subject which for the moment is of interest to himself and so I have selected an essentially gynecological subject.

There are other reasons why I have selected this particular gynecological subject. In the first place, although it is a generally accepted fact that the support furnished by the levator ani muscle, either with or without its investing fascia, is essential to the pelvic organs, none of the older methods of perineorrhaphy provides a means of such suture. In the second place, it is surprising how many of the present generation of gynecologists are content to continue to practice these operations, because, and this is my third reason for my choice of subject, they consider and in fact they are directly told that suture of the muscle, however essential it may be, is a difficult operation, and one not devoid of danger. I do not think that I need spend much time in defending my first reason. Lawson Tait, a Martin, a Hegar, and Kelly's original operations all neglect to take the levator ani muscle into consideration. It is true that occasionally they may result in causing its suture, but this only occurs when the muscle is not far retracted, while when it is retracted, and when its suture is more imperative, they fail. As to my second reason, any gynecologist present can say whether or not it is right, as well as I, and he can say whether my third reason is not also right, and whether the omission to suture the muscle is not the result of the idea that such suture is difficult.

Döderlein and Kronig, in the latest edition of their work on gynecological operations,

and Martin of Bumm's Clinic, in an article on the suture of the levator ani muscle and fascia, are largely responsible for perpetuating this idea. They however are apparently strong advocates of suture, and it seems a pity that their writings should rather tend to complicate the operation, and so to prevent its universal adoption.

I have practiced systematic suture of the levator ani muscle for the past six or seven years, and I think I may say that I have sutured the muscle in every case in which I have performed perineorrhaphy during this period except where the muscle was absent or atrophied, but when I stated this fact at a discussion on the subject, I was told that I never sutured it. The reasons given for this statement were first, that Kronig showed how easy it was to mistake a more superficial muscle for the levator ani, and secondly that Martin said that suture of the levator ani was a difficult operation involving an extensive dissection, whereas my operation was a simple and easy one. It is just because it is simple and easy that I take up the time of the Congress with this paper in which I desire to show first, that there are no anatomical difficulties in the way of muscle suture, and secondly that there are no practical difficulties.

The structures which are involved in a perineorrhaphy operation from without in words are as follows:

- 1 Skin
- 2 Superficial fascia.
- 3 The constrictor vaginae muscles, and the superficial transverse perineal muscle
- 4 The deep transverse perineal muscle
- 5 The levator ani muscle
- 6 The vaginal mucous membrane

We may at once dismiss a number of these structures from consideration because their suture is a part of any perineorrhaphy operation that has ever been devised. These are the skin and superficial fascia, the constrictor vaginae and superficial transverse perineal

muscle, and the vaginal mucous membrane. This leaves two muscles for consideration—the deep transversus perinei and the levator ani. The deep transversus perinei muscle rises from the neighborhood of the point of union of the pubic and ischial ramus. As it approaches the middle line it spreads out. A few of the most anterior fibers pass in the anterior wall of the vagina, and lie behind the urethra. The remaining fibers pass behind the vagina to the central point of the perineum. (Thompson.) A great deal of importance has been attached to this muscle by Kronig, who apparently considers it is a structure which is sufficiently long both to afford support in cases of slight prolapse, and to be mistaken for the levator ani. In his description of perineorrhaphy as performed in cases of slight prolapse, he says that after the initial incision the fibers of the deep transversus can be seen, and their course demonstrated by traction. They lie over the puborectal part of the levator muscle, and have often been mistaken for the latter. To prevent this mistake the diverging muscle bundles should be followed to the sides, the deep transversus perinei passes towards the ischial tuberosity while the levator ani passes forwards towards the pubis. He then goes on to show how this muscle can be sutured.

There are two points raised here with which I must deal at once. The first is that Kronig regards the deep transversus perinei as a structure which can not only be easily found, but which is strong enough to be used to reconstitute the pelvic floor. I should hesitate to say in the face of so eminent an authority that I did not regard either of these statements as correct, even though anatomists and one's own personal experience showed that they are incorrect, was it not that on an earlier page of the same article, Kronig himself places the importance of the deep transversus perinei before us in a true light. Here Kronig definitely states that the deep transversus perinei in nulliparae is as thick as the little finger while in multiparae, and those with poorly developed muscles it is reduced to mere strands of muscle fiber. It is thus apparently possible that

when one comes to perform a perineorrhaphy in the muscular nullipara, one may be able to find and to derive help from the deep transversus perinei!

My second point concerns the anatomy of the muscle, and that there is something radically wrong in Kronig's statements about it is shown by comparing his anatomical drawing of the deep transversus perinei with his drawing of the same muscle as exposed during operation. It is difficult to conceive how a muscle possessing the anatomical relations shown in the first drawing could come into the position in which it is seen in the others. As I have said I hesitate to express an opinion contrary to such an eminent authority but still I cannot help pointing out that I think the fibers which in his drawings of perineorrhaphy purport to represent the deep transversus perinei, really represent some bundles which have been accidentally isolated from the lower and inner edge of the levator ani. Martin puts the case very well when he says,

It is anatomically scarcely possible that Kronig could see the deep transversus passing out from the pubis to the walls of the vagina, when operating on cases with marked atrophy of the muscles. I think then that Kronig's drawings lay a quite unnecessary and a most perplexing stress on the possibility of confusing the two muscles.

The part of the levator ani with which the gynecologist is concerned rises from the back of the body of the pubis, along an oblique line which extends from the lowest limit of the symphysis upwards and outwards to the obturator canal, and also from the obturator fascia for a limited extent. (Thompson.) It passes backwards at the side of the vagina, about half an inch above the hymen, and then similarly at the side of the rectum to be inserted mainly into a median raphe between the anus and the tip of the coccyx. It has also apparently a slight insertion into the vaginal and rectal walls at the point at which it crosses the latter and it sends a few fibers to meet those of its fellow of the opposite side in the central point of the perineum. It has not, however, any considerable insertion into the perineum, and the union of its fibers which are produced in

this region by operation I purely artificial, and in no way a reproduction of the condition of affairs existing before laceration occurred. If the finger is passed high into the vagina of a nullipara, and then drawn down along one lateral wall exerting a slight outward pressure, it comes to rest on the upper surface of the muscle, the extent and relations of which can be readily ascertained. It will also be obvious that the main masses of the muscle pass backward at each side of the perineal body with a distinct separation between them. If a similar examination is made in a case of fairly extensive perineal laceration, the lateral masses of the muscle will still be felt but the gap between them will be greatly increased, in consequence of their outward retraction. Further if a similar examination is made in the case a patient in whom suture of the muscle has been carried out, the upper border of the lateral masses will be obvious, and so will the fact that they actually meet one another in the middle line throughout the whole anteroposterior depth of the perineum. Lastly if the muscle is exposed from below and if it is caught in a forceps and drawn down, the finger in the vagina readily proves that the forceps is holding the muscle which forms the pelvic floor and no other. For this reason I have no hesitation in saying that it is impossible for any one who has become at all familiar with the details of the operation to mistake the muscle for any other structure in the pelvic floor.

Just as the possibility of mistaking a practically non-existent structure for the levator ani has been exaggerated, so has the difficulty of the operation and the extent of the dissection required. I cannot understand this latter exaggeration but, to show that it exists, I quote a sentence from an article by Martin of Bumm Clinic in which he describes an operation that appears to have very few points of difference from the one I habitually practice. Martin writes: "If the fibers of the levator ani are to be brought into view the connection between the pelvic fascia and the superficial diaphragmatic fascia must be divided. This, however, means a very deep dissection, and causes hemorrhage if a broad strip of the puborectalis is

laid bare, because one is working in the neighborhood of the rectovaginal venous plexus. When the muscle is approximated, the needle frequently pierces this plexus, and so causes emboli as Bumm has described."

I have criticized adversely from the standpoint of my own experience both Koenig's and Martin's efforts to attach difficulty and danger to the routine suture of the levator ani. There is however one disadvantage of a slight character to which they both allude, and which I think requires attention. I refer to the fact that the exposure of the muscle and its separate suture leads to the formation of dead spaces between the vaginal mucous membrane and the upper surface of the muscle. If these spaces are allowed to remain in a condition in which blood can accumulate in them, infection of the clot from the rectum is very likely to occur and to convert the hematoma into an abscess. There is, however, a very simple and essential method which I shall presently describe, of obliterating such spaces, thereby preventing the accumulation of blood in them.

Before describing the operation which I have evolved, and which I habitually practice, I would like to say that I do not claim anything original for it, and that so far as I can see, identical principles of operation must have been adopted by many others. It is only because so many gynecologists seem to consider that routine muscle suture in the course of a perineorrhaphy is difficult and hesitate to perform it on this account that I describe my own technique which I have followed practically unchanged for the last six years. I cannot give the total number of cases on which my assistants or myself have operated but during the last three and a half years, 346 perineorrhaphies for chronic laceration have been performed at the Rotunda Hospital, in practically every one of which the levator ani has been sutured. In an occasional case, union has failed to occur in an occasional case—particularly in the early ones—a hematoma has formed, but there has never been a death, or even a patient whose condition gave rise to anxiety owing to the occurrence of emboli from punctured venous plexuses.

I should also like to say in case the slides of the operation appear familiar to some of you, that the drawings from which they were made were made just two and a half years ago for me from my operations, and that I take no responsibility for their resemblance to any other illustrations which have been drawn and have appeared since. Within the last two months I have had certain anatomical details in them slightly altered, as the levator muscle was placed at too superficial a level.

The essential features of the operation are as follows:

1. The careful dissection of the necessary amount of vaginal mucous membrane from the rectum.

2. The exposure and suture of the separated levator ani muscles.

3. The careful approximation of the cut edges of the vaginal mucous membrane, in such a manner as to leave no projection or redundancy.

The operation is carried out as follows. The extent of the perineal tear is carefully determined and its anterior edges are marked out by bullet forceps. A third bullet forceps is applied to the perineal skin just behind the posterior edge of the tear. The position of the separated edges of the levator ani is by palpation through the mucous membrane of the vagina. An incision is then made from side to side along the line of junction of the skin and the vaginal mucous membrane. This incision cuts through the skin and any underlying scar tissue. A flap of vaginal wall is then dissected up off the underlying rectum. At its lowest part it is firmly held to the rectum and the sphincter ani by catgut bands. The result of the old cicatricial healing. As soon, however as these have been cut through, the separation of the remainder of the flap by blunt dissection is an easy matter. The easiest method of dividing these bands with the scissors so as to avoid injuring the rectal wall is shown. When the dissection of the flap is complete a triangular piece is exposed, which is bounded laterally below by the remains of the superficial vaginal and perineal muscles, and at a deeper level by

the pubococcygeal fibers of the levator ani muscle while its floor is formed by the rectum. It is then an easy matter to catch the edges of the levator ani with clip forceps or dissecting forceps, and to draw them downward and inward until they meet in the middle line. If the separation and atrophy of the muscle is marked, then it may not be possible to draw the edges down sufficiently but in the great majority of cases, they can be brought into view as shown. Three or four interrupted sutures of catgut are then passed through them from side to side so that when tied they will approximate them in the middle line, for the present, however they are left untied. The next step is to trim the vaginal flap into proper shape, so that, when the operation is complete, there may be no redundancy. The usual line of incision is shown, and the effect of the removal of redundant tissue. The cut edges of the flap are then brought together by a continuous catgut suture passed from above downward, and ending at the vulvar orifice. This being done, the catgut sutures in the levator muscles may be tied. The last step consists in the introduction of silkworm gut sutures passed so as to close the skin edges of the perineal wound. These sutures are passed from side to side and traverse the skin, and the remains of the superficial perineal muscles and also the levator muscle so as to supplement the buried catgut sutures.

Sometimes during this procedure there may be hemorrhage from the hemorrhoidal vessels. Any bleeding vessel, if of large size should be caught and tied but, as a rule, the best method of stopping bleeding is by proceeding rapidly with the operation.

I have mentioned the tendency there is to the formation of dead spaces between the vaginal mucous membrane and the upper surface of the levator ani, as a result of the necessary stripping up of the vaginal flap and the separation of the edges of the muscle from the sides of the vagina. The final step of the operation is directed towards the prevention of the accumulation of blood in such spaces, and is, in my opinion, an essential precaution. It consists in the firm plugging of the vagina with iodoform gauze. The

plug must be applied most carefully so as to avoid injury to the vaginal sutures, and in such a manner that it lies wholly above the muscle with the exception of the end which hangs out through the vulvar opening. It is quite impossible to introduce it satisfactorily by merely pushing it upwards through the narrowed orifice. The reconstituted perineum must be drawn carefully backwards by means of a narrow retractor passed into the vagina, so as to lie above the levator muscle. The retractor which I use for the purpose is known as Doyen's anterior vaginal retractor. Though intended as an anterior retractor it possesses a blade which is set at just the correct angle to the handle to allow it to pull back the posterior vaginal wall and the muscle in the manner required for the insertion of the plug. By means of it, it is possible to introduce a strip of gauze about three inches wide and some five to six yards in length in such a manner that, while the gauze expands the upper part of the vagina and keeps the posterior vaginal wall in close contact with the sutured muscle, it throws little or no strain on the sutured mucous membrane which lies below it.

I have described this step in detail because I attach very great importance to it, and because it is impossible to carry it out satisfactorily without a suitable appliance such as the retractor I mention.

The advantages of the foregoing operation are its ease and its rapidity. In an ordinary uncomplicated case it can be finished in less than ten minutes, and it very rarely takes more than fifteen minutes. The advantages of positive suture of the levator and in perineorrhaphy operations are so obvious that they do not require mention but to emphasize

them I show four diagrams, which I constructed with fair accuracy from two cases of perineorrhaphy. The first pair of these show the condition of the perineum and the relations of the rectum and the vagina in a patient on whom one or the other of the older perineorrhaphy operations had been performed. The external results was apparently excellent, but on passing the finger into the vagina, the perineum was found to consist of a thin shelf formed of skin and superficial fascia. A little further examination showed that the lateral masses of the levator and muscle, well developed but widely separated, lay in the position into which they had retracted as a result of the original laceration. The second pair of diagrams show the same points in a patient in whom the muscle had been sutured and the operation carried out as I have described. The difference in the condition of the perineal body is at once obvious, and further examination showed that the lateral masses of the levator met in the middle line. In fact, the shape of the perineum is practically that found in the nullipara, and the only difference is that the inner muscle edges meet in the middle line instead of merely sending a few fibers into the central tendon of the perineum.

#### CONCLUSIONS

1. Routine suture of the levator and is an essential part of perineorrhaphy.
2. Routine suture is always practicable, except when the muscle is wanting owing to atrophy after injury. Such absence is very rare, and, when it occurs, it is impossible to reconstitute the perineum satisfactorily.
3. The exposure and suture of the levator and is neither difficult nor dangerous.

HYPERTHYROIDISM PRIMARY AND LATE RESULTS OF OPERATION<sup>1</sup>

By C H MAYO M D ROCHESTER, MINNESOTA

THE term hyperthyroidism is so expressive of a group of symptoms the symptom complex of which has been seen and described under various names in all countries that it is chosen as the title of this study.

Through one hundred and fifty years the condition has been a topic of discussion by Morgagni (1) Flajani (2) Parry (3) Graves (4) Basedow (5) and later under the term exophthalmic goiter by innumerable other observers.

The thyroid is a very necessary gland in the growth and development of body and brain and must also be classified among both the glands of nutrition and the glands of defense. Like all the essential organs and kinetic glands of the body it has a wide variation of its activity within the limits of health. Probably the secretion of one-sixth of the adult gland is enough to maintain the metabolic balance, which is no more surprising than that one-half of one kidney will maintain urinary balance. A similar condition exists in many other organs of the body.

Many factors exist which control such organs in order that the balance of health may be maintained yet any or all of them may be temporarily deficient or overactive in their functions but, unless there be an actual great loss of cells or a markedly hyperplastic condition they are held in control. In this variation of activity in the normal thyroid, and in the normal changes in activity of its various vesicles, the thyroid sometimes manifests a storage function, retaining for a time its secretion and depositing colloid substance for this purpose.

This almost brainlike intelligence of the glands, both duct and ductless, shows why so futile is the effort to transplant glands from other animals to the human, with the expectation that the gland will automatically functionate. Especially is this true of the reported cases of the transplantation of glands from animal to man, in which there is always a definite lacking of the blood. A

temporary benefit may be obtained, however from the transplantation of the glands of internal secretion through the digestive power of the phagocytes.

That there should be a definite microscopic picture in so definite a disease as hyperthyroidism is to be expected. The only organ that gives such an exclusive picture is the thyroid. The trained pathologist should not only recognize the condition but also its degree of activity and its stages that is, whether progressing regressing or regenerating.

The coincident pathology of the other essential organs such as nephritis fatty degeneration of the liver myocarditis, and brown atrophy of the heart muscle while characteristic of toxemia would not necessarily come from the toxic thyroid. The enlarged thymus is found in a majority of cases of hyperplastic thyroid yet is not found in many of the most serious cases.

In the pathologic examination the whole of the tissue removed must be macroscopically observed, that an unessential small area of hyperplasia or of colloid storage be not chosen as the sole picture of the glandular histology. The changes in so small an amount of tissue may be neutralized by other factors. The pathologic material from our cases has been studied by Wilson (6). In his most recent paper he presents a comparative study of the thyroids from the three groups of cases which we recognize clinically (Plummer). They are summarized as follows (Table 1).

1. Practically all cases of clinically true exophthalmic goiter show marked primary hypertrophy and hyperplasia of the parenchyma of the thyroid. Furthermore, the clinical stage of development of the disease is paralleled by the stage of development of the pathologic condition in so sufficiently marked a degree that one may estimate the clinical condition from the pathologic examination with about 80 per cent of accuracy. The degree of severity of the clinical condi-

TABLE I—COMPARISON OF PATHOLOGIC GROUPING OF THYROID FROM CASES OF TOXIC HYPERPLASTIC, TOXIC NON HYPERPLASTIC AND ATOMIC (SIMPLE) GOITER

	PERCENTAGE DISTRIBUTION					AVERAGE AGE AT OPERATION				
	Toxic goiter	Toxic nodular (of toxic) Group	Toxic nodular (of toxic) Group + Simple	Toxic nodular (of toxic) Group + Simple	Simple (nontoxic) goiter	Simple goiter	Toxic nodular (of toxic) Group	Toxic nodular (of toxic) Group + Simple	Toxic nodular (of toxic) Group + Simple	Simple (nontoxic) goiter
	From 41 cases	From 49 cases	From 107 cases	From 107 cases	From 27 cases	From 41 cases	From 100 cases	From 107 cases	From 107 cases	From 27 cases
A Early primary parenchymatous hyperplasia and hypertrophy	Per cent	Per cent	Per cent	Per cent	Per cent	3 cases	3 cases	3 cases	3 cases	3 cases
B Advanced primary parenchymatous hyperplasia and hypertrophy	75					75				
C Regressive primary parenchymatous hyperplasia and hypertrophy	2					2				
Average of total parenchymatous hyperplasia and hypertrophy	5					5				
D Scarce foci representing in atrophic parenchyma of goiter	30						30	32		
E Focal adenoma			30	30			30	1	30	30
F Disorganizing focal lesions			10	10	3		43	30	43	40
Average of total focal lesions			40	40				33	33	30
G Adult colloid metastasis			71	70				41	43	30
H Atrophic parenchyma (colloid) thyroiditis, adenomatous, etc.			41	44			33	46	43	37
Average of total atrophic parenchyma, adult parenchyma			61	64	6-				44.6	37
AFTER DURATION OF GOITER BEFORE OPERATION										
	Years	Years	Years	Years	Years	Years	Years	Years	Years	Years
A Early primary parenchymatous hyperplasia and hypertrophy										
B Advanced primary parenchymatous hyperplasia and hypertrophy	35					35				
C Regressive primary parenchymatous hyperplasia and hypertrophy	21					21				
Average of total parenchymatous hyperplasia and hypertrophy	33					33				
D Scarce foci representing in atrophic parenchyma of goiter							47	300	71	11
E Focal adenoma							46	97	30	30
F Disorganizing focal lesions			33	34			94	136	100	30
Average of total focal lesions				30			8	146		147
G Adult colloid metastasis							30	34	100	147
H Atrophic parenchyma (colloid) thyroiditis, adenomatous, etc.			30	30.5			140	136	36	100
Average of total atrophic parenchyma, adult parenchyma				16			30	100	105	

tion is similarly paralleled by the pathologic condition of the gland. The relationship between hypertrophy and hyperplasia of the thyroid and the clinical symptoms of true exophthalmic goiter is remarkably constant.

2 While mild degrees of hypertrophy and hyperplasia within physiologic limits may be present in the gland particularly in the young and during pregnancy yet the absence of this condition in the thyroids of adults coming to operation for toxic non-exophthalmic and non-toxic goiters is most striking. Without making any allowance for either clinical or pathologic errors of diagnosis, less than one per cent of all cases coming to operation for goiter show any considerable primary hypertrophy and hyperplasia of the parenchyma of the thyroid except as associated with clinical symptoms of true exophthalmic goiter.

3 The pathology of toxic simple goiter is marked essentially by atrophic parenchyma, decreased function and decreased absorption. The process is a chronic one.

4 The pathology of toxic non-hyperplastic goiter of Plummer's (?) Clinical Group 2 (that is, those resembling exophthalmic goiter) is one of increased parenchyma through regenerative processes in atrophic parenchyma or the formation of new parenchyma of the foetal type with an increase in each instance of secretory activity and of absorption. The process is a chronic one but sufficiently active to cause the patient to consult a surgeon earlier than do those in Clinical Group 1.

5 The nearer the cases of Clinical Group 2 (toxic non-hyperplastic) approach in age and symptoms, true exophthalmic goiter, the shorter the duration of the period of goiter before operation and the smaller the average weight of the gland at the time of its removal.

6 The cases of toxic goiter of Clinical Group 1 (that is those in which the symptoms are of the cardiovascular variety) much more closely resemble cases of simple goiter in their pathology in all respects than do the cases of Clinical Group 2. A larger number of them are of the colloid goiter type, the enlargement of the thyroid has existed for a

longer period before operation and the portion of the gland removed is materially larger than in those cases of Clinical Group 2.

7 Finally it may be stated that all the above pathologic evidence points to a constant relative association of increased secretion and increased absorption from the thyroid proportional to the degree of toxicity on the part of the patient. We have as yet no absolute proof that such secretion and absorption is the cause of rather than co-ordinate with the symptoms, but the presented evidence strongly points to that conclusion.

What causes an overactivity of the thyroid? It is possible that the condition may arise from extra demands made upon the gland in its capacity for nutrition or defense in toxic conditions. Possibly in its latent sex relationship such demands may be temporary or long continued. For a time the excess secretion may be neutralized. When shock is attributed as the cause of the sudden onset of hyperthyroidism, it is often only an evidence that the equilibrium of the nervous system has been upset in the presence of a latent hyperplastic thyroid thus producing the sudden symptoms which had previously been controlled or neutralized.

Up to July 1, 1914, 6906 operations had been performed for goiter in our clinic. Of these 3327 were performed upon patients with hyperthyroidism. The greater number of these patients have been seen clinically by Plummer. His observations on the symptoms are as follows:

The cases were classified clinically as hyperplastic toxic, hyperplastic atoxic, non-hyperplastic toxic, and non-hyperplastic atoxic.

Patients coming under observation with non-hyperplastic toxic goiter gave a history of having first noted the goiter at the average age of 22 years and the evidence of intoxication at the average age of 36.5 years. The corresponding ages for hyperplastic goiter were respectively 32 and 32.9 years.

That non-hyperplastic toxic goiter was noted 10 years earlier in life than hyperplastic toxic goiter that 14.5 years elapsed between the appearances of non-hyperplastic goiter and



If the average course of the intoxication be represented by a curve, the greatest height is reached during the latter half of the first year and then suddenly drops to the twelfth month. In many instances it reaches the normal base line during the next six months. More often it fluctuates with periods of exacerbation for the next two to four years. Secondary symptoms and exophthalmos may remain, but the active course only rarely continues over four years without distinct intermissions. Compare the striking resemblance of the character, order of onset, and course of this train of symptoms with that resulting from the heavy use of alcohol by a susceptible individual over a corresponding period of time. Near the crest of the curve any shock, operation, etc. that treats the patient to another drink may result in tremors or death.

"In the average course after the first year the symptoms that may be attributed to long-continued intoxication rather than to a high degree of acute intoxication—that is those from the more chronic types of heart, liver and degeneration of the kidney—enter into the clinical picture. In attempting to construct a composite curve we find that the curves of those symptoms that we can readily attribute to a high degree of immediate intoxication from the thyroid gradually drop while the curves for those findings attributable to a long-continued intoxication of a lower degree gradually rise.

The various types of goiter should be treated both medically and surgically. Many goiters of the simple and mild exophthalmic type undoubtedly regress spontaneously although various forms of medical treatment may hasten the recovery and restoration of the gland to an apparently normal condition in many instances, especially in the early stages of simple goiter.

Exophthalmic goiter is essentially a disease of a chronic character presenting exacerbations and ameliorations of symptoms extending over a period of months or several years. After the first year the gland often undergoes a regression.

While this disease is amenable to surgical treatment by the removal of a large amount

of the hypersecreting gland it is by no means urgent surgery and all patients during periods of exacerbation should be considered as medical cases. Surgery is indicated in the up-wave of improvement. The majority of these cases can withstand thyroidectomy at the time they are seen by the surgeon. Extreme conditions especially dilatation of the heart may require medical preparation, and the operative interference following in cases resistant to treatment should be confined to injections of boiling water into the gland after Porter's (8) plan to hasten improvement. In most of the severe cases a ligation is made first of the left upper pole only. Should the reaction following this be severe the ligation of the right upper pole is indicated a week later and thyroidectomy reserved until four months have elapsed, by which time these patients have made an average gain of twenty two pounds, with great general improvement. However if the reaction following the left ligation is not unduly severe a partial thyroidectomy may be made at the second operation the week following.

*Ligation.* The ligation of vessels as an operative procedure was performed in the early part of the nineteenth century and later revived by Wodder. The ligation of the superior thyroid arteries is made through a transverse incision over the center of the thyroid cartilage. The incision is made through the skin and platysma muscles. Blunt dissection with spreading probe pointed scissors exposes the inner border of the sternomastoid muscle which is drawn outward. The anterior belly of the omohyoid muscle is next exposed, elevated, and drawn inward which brings into view the upper pole of the thyroid with its vessels. A permanent ligature is passed around these veins and arteries, close to the gland or even including its tip. This prevents reversal of circulation by esophago-anastomosis, which occurs from high ligation of the artery. Injury to the nerve is not feared, as here the incision is made between the superior and inferior laryngeal nerves and the gland is easily approached. No drainage is necessary. According to the purpose of the operation, and to the condition

the development of notable toxic symptoms and that the constitutional symptoms were noted but a few months later than the goiter in the patients affected with hyperplastic thyroid, was alone sufficient to show that we were dealing with at least two distinct pathologic and clinical groups. That one was not the sequence of the other was self evident.

We may safely come to the conclusion that exophthalmic goiter is a definite clinical complex always associated with hyperplasia of the thyroid and that it should be sharply distinguished from the constitutional state that may develop with non hyperplastic goiter.

Let us note the parallelism of thyrotoxicosis and alcoholism and assume that there are three toxic elements in the thyroid secretions: one damaging chiefly the nervous system, one the circulatory system, and the other producing exophthalmos. In exophthalmic goiter all three elements are in excess but the clinical picture is dominated by a nerve toxin although in individual cases the circulatory toxin or element producing exophthalmos may seem to be in excess.

"The intoxications from non hyperplastic goiter may be divided into two merging groups. (1) A group in which the cardiac toxin predominates, in which the clinical picture closely resembles and in many instances cannot be differentiated from the cardiovascular complex resulting from alcoholic, luetic, septic, and other well known toxins. (2) a group more closely approaching the picture of Graves' disease and including the cases that have been erroneously so diagnosed by the mass of the profession. (In this group are those cases in which there is degeneration of encapsulated adenomata. While they do not have exophthalmos, in lieu of this they may have the staring and widening of the palpebral fissure. The pulse is irregular in tension and rhythm. Circulatory changes and muscular weakness are marked. Many of them have been treated for hyperthyroidism and some of them rendered worse by the further degeneration of the gland which has been induced by cytolytic serums.)

"The average lapse of time between the appearance of non-hyperplastic goiter and toxic symptoms is 14.5 years. That the patient comes under observation three years later indicates that the onset is usually insidious. Nervousness, tremor, loss of strength and weight as a rule, develop slowly but may appear suddenly long before definite evidence of myocardial damage. The administration of iodine may cause the sudden appearance of those symptoms with myocardial insufficiency much as they might follow the prolonged drinking bout of an old toper who had not previously shown decided evidence of chronic alcoholism. In some cases the clinical aspect, as noted above, closely approaches that of exophthalmic goiter. However the symptoms are less complex, less definitely associated, and, except for a damaged heart less intense. There is much evidence to suggest that during the 14.5 years previous to the onset of definite toxic symptoms many of the cases of non hyperplastic thyroid may be compared to the alcoholic tippler in that if the roll is right they develop arteriosclerosis, in many cases showing the combined picture of thyrotoxicosis and arteriosclerosis.

The development of a typical syndrome of Graves' disease in a case having a definite history of simple goiter means that a hyperplastic goiter has been superimposed upon the simple type.

"The onset of exophthalmic goiter is as a rule, relatively acute and the course of the disease fairly definite. The clinical picture early in the history is that of a toxin acting directly on the more vital organs, more notably on the central nervous and vascular systems. Later it is made more complex by the interaction of those organs whose functions have been directly disturbed by the toxin. The order of onset of the most important symptoms based on the a crage of our series is as follows: (1) Cerebral stimulation, (2) vasomotor disturbances of the skin, (3) tremor, (4) mental irritability, (5) tachycardia, (6) loss of strength, (7) cardiac insufficiency, (8) exophthalmos, (9) diarrhea, (10) vomiting, (11) mental depression, (12) jaundice, and (13) death.

are required in simple goiters while the hyperplastic types require many. However in the excision of an exophthalmic goiter one must keep close to the gland and it is well to divide the capsule along the lateral border which is caught in many clamps and the gland more carefully enucleated saving this capsule, which effectually protects the recurrent laryngeal nerves and also the parathyroids.

The anesthetic of choice in most cases is ether. Complicated cases, however may be best carried through the operation by the local use of 0.5 per cent novocaine solution with the addition of a little adrenalin. Occasionally the combined use of a local with a general anesthetic is advisable, a method which Crile has done much to popularize the local anesthetic relieving the pain necessitates less of the general anesthetic to secure sleep.

In severe forms of Graves disease the use of  $\frac{1}{100}$  grain of scopolamine with  $\frac{1}{4}$  grain of morphine one hour previous to operation is often a distinct advantage. Some patients seem to have an idiosyncrasy to the drug and in such cases the operation must be postponed twenty four hours to permit elimination. In all cases in which ether is used as the general anesthetic  $\frac{1}{100}$  grain of atropine should be given one-half hour before operation to maintain a dry trachea and pharynx during the operative procedure.

**Mortality.** The great lowering of mortality following operation for exophthalmic goiter is due less to trivial details of technique than to the better judgment in the preparation of patients, the selection of a time type and extent of operation and its division into stages, with varying intervals of rest. The high mortality of the past is no longer a determining factor against the surgical treatment. As many as 278 consecutive operations have been made on the thyroid between deaths occurring from the operation. The average operative mortality at present probably varies from one to three per cent. Relapse of some degree occurs in a small percentage of cases through the removal of too small an amount of the thyroid. Such cases should be reoperated.

The following is the report of a few interesting cases ranging from one to several years since operation.

CASE 1 95443 O E L Male, married age 30 Examined November 3, 1913 *History* Onset of symptoms five months prior to examination, loss of nervousness, tachycardia, exophthalmos, and loss of strength. Goiter had been noted for fifteen months. Six weeks prior to examination, tremor, dyspnea, insomnia, and sweating developed. Symptoms steadily increasing. Loss of weight twelve pounds. *Examination* Marked evidence of all the preceding symptoms definite exophthalmos, bruits in superior thyroid vessels, dilated heart pulse 1. *Operation* November 20, 1913. Ligation of left superior thyroid vessels followed by thyroidectomy seven days later. February 19, 1914 patient reports great improvement has gained twenty pounds in weight pulse 80 exophthalmos less marked nervousness greatly reduced.

CASE 2 94464 A H T Male, married, age 40 Examined October 27, 1913 *History* Acute articular rheumatism five times. Ten months prior to examination the patient became nervous, with tremor, dyspnea, palpitation, tachycardia, and loss of strength. Eight months later goiter and exophthalmos were noted. *Examination* Marked exophthalmos forty pounds loss in weight, bruits in superior thyroid arteries. *Operation* Thyroidectomy on November 3, 1913. February 10, 1914 patient reports himself cured, gain of twenty five pounds in weight pulse 72 exophthalmos greatly improved only slight nervousness.

CASE 3 9437 E B Female, single age 20, height 5 feet 6 inches Examined October 25, 1913 *History* Nervousness, tremor, dyspnea, palpitation, tachycardia, loss of strength, sweating, and prominence of the eyes for one year. Ten months previously there was an attack of vomiting and diarrhea, following which the patient was in bed for four months and lost fifty pounds in weight. She then improved until one month before examination, when she began vomiting and exhibited evidence of increased intoxication. *Examination* Definite exophthalmos marked thrills and bruits in the superior thyroid vessels pulse 3. *Operation* On November 3 and 9, 1913, the thyroid vessels were ligated. February 1, 1914 the patient reported steady gain in strength, increase in weight of ten pounds, and general improvement.

CASE 4 94566 A B Female, married age 26 height 5 feet 8 inches Examined November 9, 1913 *History* No children goiter for six years. All the features of nervousness, tremor, palpitation, tachycardia, loss of strength, diarrhea, exophthalmos, and extreme intoxication existed during the first year. Since then, symptoms fluctuating but never returning to normal. She was able to do some housework. *Examination* First degree of exophthalmos, thrills and bruits in both thyroid vessels. The pulse was 50 heart dilated.

of the patient one or both sides may be ligated at the same time.

**Ligation of the Inferior thyroid artery** is made through a lower transverse incision between the insertions of the sternomastoid and requires elevation of the lobe of the thyroid and exposure of the vessel at the point the ligature is applied so that nerve-tissue may not be included. This operation is usually done only for those patients suffering from a severe relapse after a partial thyroidectomy. Operating thus in stages may be advisable in certain cases, especially of exophthalmic goiter; for example, the upper left pole may be ligated under novocaine. Should severe reaction ensue a few days later the right ligation is made from which there is less reaction. If the primary operation has been made without marked bad effect upon the patient the secondary operation of thyroidectomy may be done in about a week. In the cases in which only double ligation has been done at an earlier period, the larger part of the gland may be removed at the end of four months. By this time the patients who have been under weight will have gained an average of twenty-two pounds and the thyroidectomy can be made with safety.

**Sympathectomy** The Jaboulay operation is a cervical sympathectomy of the superior and sometimes of the middle ganglia and is employed in those cases in which the exophthalmos is marked the nervous symptoms active, and the gland small. In such cases the superior thyroid vessels are often ligated in the same incision. This operation can be done with novocaine as a local anæsthetic, but is preferably made with a general or combined anæsthetic. Incisions are made in the lines of the natural creases in the neck opposite the bifurcation of the carotid. The sternomastoid is drawn outward and a blunt dissection is made down to the jugular and carotid veins, which are then drawn inward. The posterior sheath of fascia inclosing these vessels is opened that the vagus nerve may be kept under observation, since this nerve is bulbous above this point and may be confused with the sympathetic.

Under normal conditions the sympathetic

ganglion is one-eighth to one-fourth of an inch wide. Many branches lead from it on either side. The connecting branches are divided, the upper part of the ganglion torn off or cut, and the lower portions of the nerve cut or torn off at the middle ganglion unless the middle ganglion is also removed.

**Thyroidectomy** The angular or bayonet incision is made for the removal of high lying goiters which have developed in the upper pole of the gland. The best general exposure of the thyroid is through a low collar incision, commonly known as the Kocher incision which includes the skin and platysma and extends laterally to the external jugulars. The skin with platysma is dissected upward and also downward uncovering the sternohyoid muscles. These are separated by a vertical incision which includes the fibrous capsule over the gland. Lateral traction separating the two sternohyoid and also the sternothyroid beneath them, exposes the thyroid gland sufficiently and gives enough room for the removal of small goiters. However in large and exophthalmic goiters it is necessary to divide the sternohyoid muscle in the upper part of the field over the thyroid cartilage. This is important since, when reunited it preserves the nerve supply and breaks the line of closure of skin and muscle, preventing a muscle drawn scar which moves with deglutition. The sternohyoid can usually be retracted but should be divided if it limits the working field. Many of the troubles and accidents in the surgery of goiter would be avoided if the preliminary exposure of the thyroid were adequate before proceeding with the gland itself.

The lateral ends are caught and divided between clamps. The gland is gently elevated with the hand, and under slight tension the vessels at the upper pole are caught and divided between forceps. This is repeated on the anastomosing vessels close to the isthmus. The vessels at the lower pole are treated in the same manner the gland being held in the hands of an assistant, who keeps up continual traction gradually elevating and turning with the isthmus across the trachea where the separation is made along the opposite lateral lobe. Few forceps

A children In 1906 patient developed nervousness, tremor, tachycardia, palpitation, dyspnoea, oedema, diarrhoea, and loss of strength. One year prior to examination exophthalmos appeared six months later goiter. Symptoms severe during first year fluctuating since then. *Examination* Marked Stellwag arrhythmia, pulse about 100. *Operation* January 23 1909, thyroidectomy February 10, 1914, patient greatly improved and doing customary work pulse 80 eyes improved gain in weight.

CASE 4. 8483. A. W. B. Female married, age 30. Examined December 19, 1908. *History* Marked exophthalmos in 1904. One year later goiter, nervousness, tremor and dyspnoea, symptoms gradually progressing. *Examination* Marked exophthalmos cardiac dilatation pulse 30 acute intoxication. *Operation* January 7 1909, thyroidectomy February 10, 1914 report states great improvement gain in weight 25 pounds, pulse 8 eyes improved. She is doing her customary work.

CASE 5. G528. J. S. H. Male age 47. Examined August 25, 1905. *History* Mild attack eight years prior to examination. Seven years later goiter as noted with nervousness, exophthalmos and pulse 14. Symptoms most severe the past four months. *Examination* Typical exophthalmic goiter. *Operation* August 28, 1905 thyroidectomy February 9, 1914, patient reports that he is cured. He has gained 175 pounds in weight eyes, heart, and pulse normal no nervousness.

CASE 6. G47836. P. H. L. Male age 3. Examined May 5, 1905. *History* Patient had had symptoms of tachycardia, nervousness, and tremor for a year and a half. About eight months prior to examination exophthalmos and goiter were noted. Symptoms steadily progressive. *Examination* Definite exophthalmos, enlarged thyroid, pulse 3. *Operation* May 6 1905, thyroidectomy February 9, 1914, patient reported cured. Thirty eight pounds gain in weight, pulse and heart normal, eyes moderate.

CASE 7. P367. G. H. Female married age 44. Examined May 1, 1905. *History* One child 6 years of age goiter of several years duration increased during past year with nervousness

protrusion of eyes, palpitation, and tremor. *Examination* Firm thyroid heart dilated pulse 30. *Operation* May 13 1905, thyroidectomy February 10 1914, patient cured gain of thirty five pounds in weight pulse and heart normal eyes greatly improved. She is doing her usual amount of work.

CASE 8. P 657. B. L. P. Female, married age 3. Examined June 11 1904. *History* One child seven years of age goiter exophthalmos, tachycardia, and tremor for two years. *Examination* Moderate exophthalmos slight tremor pulse 100. *Operation* June 15 1904, thyroidectomy February 10, 1914, patient reported cured pulse and heart normal eyes normal no nervousness gain of twenty pounds in weight.

It may be well to note here the effect of pregnancy during the progress of the disease or following the operation. A few of these patients are in much better health during pregnancy however in the majority the symptoms are worse. I believe that the risk to life incident to pregnancy and labor is less than from abortion which rarely should be produced, since most of these patients improve after childbirth.

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THE ORIGIN AND NATURE OF FETAL MOVEMENTS<sup>1</sup>

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**I**N an article published in 1912 on the "Pathogenesis of the Hemorrhagic Diseases of the New born," it was shown that all those diseases commonly known as Buhl's disease, Winckel's disease, melena neonatorum etc. are probably different expressions of an asphyxial process. This conclusion was based in part on the successful reproduction of the various anatomical changes characteristic of the diseases mentioned, by permanently diminishing the blood supply to the pregnant uterus of an animal shortly before labor. At that time it was noted that when any considerable disturbance of circulation was produced, violent movements of the fetus occurred. This observation suggested the query: Are all fetal movements the expressions of an asphyxia?

In studying the literature I was impressed by the fact that very little has been done to analyze the factors concerned in the production of fetal movements and almost none of this has been experimental. Braxton Hicks<sup>2</sup> was apparently one of the first to apply experimental methods to the study of this question and it was he who devised the means of graphically recording fetal movements which Ahlfeld later employed in a more detailed investigation. Ahlfeld in fact apparently has gone into the question of fetal movements more extensively than any one else. He states that there are many kinds recognized through the abdominal walls and he classifies them into extremity movements, stretching movements, physiological contractions of the diaphragm, and physiological intra-uterine respiratory movements. He states also that there are still other kinds which have not yet been recognized through the abdominal walls, namely swallowing and sucking movements. His experimental work was confined to the making of curves with

Hicks's apparatus of movements which he has designated as physiological intra-uterine respiratory movements. His reason for considering them as such is based chiefly on the fact that they are periodically recurring, nearly rhythmical, occurring about sixty to seventy times per minute, and that by means of his curves he claimed to have recognized a coincident rising of the thorax with a sinking of the abdominal region. He considers the extremity movements to be never shock-like but gliding in character, performed especially when the fetus finds need to change to a more favorable position. The stretching movements are stated to be sometimes gradual and at other times jerky. Those which are designated as physiological contractions of the diaphragm give rise to shock-like sensations felt by the mother and they are said to resemble hiccup.

Although Ahlfeld has been one of the few who have introduced experimental methods into the study of this question, yet his work apparently has been done exclusively on the human subject, and hence under conditions which he could not control so accurately as if he had used animals. He seems not even to have made direct observations on animals to determine whether in the opened uterus it is possible to observe the rhythmical respiratory movements going on in the fetus which he claims to have found by means of his curves. He does, however, record an instance of having observed in the case of a child born within the membranes five shallow respiratory movements before opening the membranes. But these occurred with intervening pauses of from one and one half to two seconds and were not such as his curves would indicate. His conclusions, however, have been accepted by Ferroni, who obtained similar curves from pregnant women. But Ducl, who also obtained similar curves from the human subject, was unable to recognize

<sup>1</sup>Quoted J. Exper. Med. 1912, 14, 309.  
<sup>2</sup>Hicks, "On Recording the Fetal Movements by Means of Oscillograph," Tr. Amer. Obst. Soc. 1886, vol. 13, p. 134.  
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 Cited by Ahlfeld.

these movements in animals. Also serious objections to Ahlfeld's conclusions have been made by Runge and Ohlshausen. Runge conceded the possibility of respiratory movements *in utero* but in two experiments with the opened uterus of pregnant sheep he failed to see rhythmical respiratory efforts. Respiratory movements occurred only after compression of the navel. Ohlshausen raised the point that the movements recorded by Ahlfeld were probably a transmission of aorta pulsations. In a later article Ahlfeld replied by stating that in a former article he had shown that aorta pulsations had nothing to do with his curves. At any rate beyond the attempt to explain this one kind of foetal movement, the existence of which he has not proven beyond criticism, Ahlfeld's work does nothing to explain the underlying factors involved in the causation of the various kinds of foetal movements.

The interpretation of the shocklike sensations experienced by pregnant women on the basis of foetal hiccup or physiological contractions of the diaphragm, seems to have originated with Mermann, although he later withdrew this idea. Ahlfeld however and more recently Commandeur have concurred in this interpretation.

The present study shows that any influence which produces a more or less severe asphyxia of the foetus induces active foetal movements. By the methods used it has been possible to determine that these movements, while chiefly respiratory in character, also frequently consist of movements of the head and extremities of such a sort that these could easily be responsible for shocklike sensations felt by a pregnant woman. They were violent and jerky in character produced sometimes by a forcible extension of the whole body although more often they consisted merely of a sudden extension of the head with or without a simultaneous opening of the mouth. Often they did resemble a hiccup although it was im-

possible to determine whether or not the diaphragm actually contracted. Extremity movements occurred both as a part of a sudden extension of the whole body as well as independently. They were sometimes distinctly shocklike particularly when involving the hind extremities, and at other times gliding in character. In one experiment, under the influence of  $\text{CO}_2$  inhalation, the movements were so violent that the foetus nearly ruptured the membranes, and immediately after making a small slit in them it propelled itself out with a violent extension of the trunk and extremities. This occurred even before the liquor amni had had time to escape and therefore apparently the exposure of the skin to the air was not an important factor. In short, *all of the various kinds of foetal movements described by Ahlfeld except the swallowing and sucking movements can arise out of the one underlying condition of asphyxia.* But the observed respiratory movements were neither rapidly recurring nor rhythmical. Moreover it has been found that these movements also follow the direct inhalation of carbon dioxide by the mother. The results, therefore, may perhaps be attributed to the effects of an increased H ion concentration in the blood of the foetus and probably of greatest importance usually is the H ion which comes from carbonic acid. Foetal movements in general therefore are brought into relation with the known facts of the origin of respiratory movements in the adult, the convulsive movements of  $\text{CO}_2$  poisoning and the hyperpnea and other muscular reflexes following the increased concentrations of such acids as lactic acid etc. in the blood. Roughly speaking late in the pregnancy the degree of asphyxia (i.e. the concentration of H ion in the blood of the foetus) up to the point of paralysis of the nerve centers, determines whether the foetal movements are merely respiratory in nature or are more violent and associated with movements of the extremities as well. It was observed, however that the movements were intensified if there was present the additional stimulus of exposure of the skin to the air. This fact has been recognized before. Runge

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showed experimentally that various reflexes other than respiratory movements occurred on irritation of the skin after opening the foetal membranes. Ahlfeld also noticed that in the case, previously cited of the infant born in the unbroken membranes, deeper respirations occurred after opening the membranes than before. Ahlfeld's contention that rhythmical respiratory movements take place in the foetus was not confirmed in the present study. But possibly the smallness of the experimental animals used (guinea pigs) precluded the recognition of rapid superficial respiratory movements.

It is an especially interesting fact that it is possible for the young to remain alive after birth even although they may have made many respiratory movements *in utero*. This fact is shown very well in Experiment 10 and it seems to indicate that the liquor amnii does not enter the lungs. Why it does not enter is by no means clear. One would expect that if the respiratory passages were open the fluid would be forced into the lungs, even without respiratory movements, because of the tendency for the pressure to be equalized in all directions. It is possible that these passages are opened only as the result of the action of such a factor as the irritation of the skin by exposure to the air.

All the experiments have been made with guinea pigs far advanced in pregnancy. The method adopted for direct observation of the foetal movements has been opening the uterus but leaving the membranes and placenta attachment undisturbed. The transparency of the membranes allows an excellent view of the contained foetus. The possibility that cooling of the foetus even in the enclosed membranes, was a more important factor than the methods taken to produce a hypercapnia was excluded by the fact that without opening the abdominal wall violent shocklike movements could be easily induced both by direct inhalation of CO<sub>2</sub> by the mother and by occlusion of the mother's trachea.

The methods used to produce an asphyxia of the foetus have been: (1) ligation of uterine vessels, (2) occlusion of the trachea of the mother, (3) direct inhalation of CO<sub>2</sub> by the mother. In all the experiments which in-

volved opening of the abdomen a light ether anaesthesia was maintained throughout and the animals were killed with ether at the close of the experiments without being allowed to regain consciousness.

Protocols follow.

#### LIGATION OF UTERINE VESSELS

*Experiment 1.* A large pregnant guinea pig was lightly anesthetized with ether and a median laparotomy incision was made. The uterus containing three foetuses was delivered out of the abdomen and clamps were applied to four branches of the uterine vessels occluding both artery and vein in each case. Within thirty seconds distinct movements could be made out within the uterus which increased in violence and became associated also with uterine contractions during the next few seconds. At the end of one and one half minutes the uterus and membranes were rapidly ligated and the foetuses, which seemed to be near term, were exposed to view leaving the placental attachments intact. The movements were now seen to consist for the most part of what were apparently attempts at respiration. At irregular intervals, averaging five to ten seconds apart, the jaws were suddenly thrown open in gasping manner the head was sometimes violently extended on the neck, and often sudden violent extension of one or more of the extremities occurred. After three and one half minutes the movements had entirely ceased and the foetuses were considered dead. The mother was then killed with ether. Some of the movements noted in this experiment resembled hiccups.

*Experiment 2.* Performed in practically the same manner as above. In this case the uterus contained only two foetuses. After exposing to view as in Experiment 1, it was noted that one at irregular intervals forcibly extended the whole body. The other showed essentially the same phenomena as already described in Experiment 1.

*Experiment 3.* Performed in practically the same way as Experiments 1 and 2 except that after discovering that there were only two foetuses it was decided to in extirpate the relative differences produced by occlusion of veins on one side and arteries on the other. The idea was that if the movements are an expression of an excessive CO<sub>2</sub> tension rather than lack of oxygen, they should be more pronounced in that foetus on the side with the occluded veins. It was found to be rather difficult to ligate separately either the arteries or veins because of their small size but finally three veins on one side and three arteries and a vein on the other side, all of about equal size, were ligated. One vein was ligated with the arteries to prevent hemorrhage since it was torn during the separation and ligature of the arterial branch. The ligation of the vessels about ten minutes time and during the manipulation rather active foetal movements were noted. The uterus was not opened

until after the ligation of the vessels. Because of the difficulty in establishing the conditions, it was impossible to compare with accuracy one fetus with the other. Nevertheless there seemed to be no doubt that occlusion of the veins alone produced much more violent movements than did the ligation of the arteries and one vein. This would seem to favor the idea that the movements are due to an increased  $\text{CO}_2$  tension rather than to a diminished oxygen tension.

#### OCCLUSION OF THE TRACHEA

*Experiment 4.* As before, the abdomen was opened under light anesthesia and the uterus exposed to view. Only one fetus was found. Pressure on the trachea of the mother was exerted until violent dyspnea and marked cyanosis occurred. During the development of the dyspnea and cyanosis active movements of the fetus were seen similar to those which have already been described and they increased in intensity with the increase in the mother's cyanosis. Also it was interesting to note that the hitherto quiet intestines of the mother showed marked peristaltic waves after the cyanosis became severe and that the most active fetal movements occurred during the period in which the peristalsis was most violent.

*Experiment 5.* In this experiment the uterus was partially delivered out of the abdomen now opened but it was allowed to remain in place. A good view of it was obtained by wide retraction of the abdominal wound. Two fetuses were found and active shocklike movements of both followed the occlusion of the mother's trachea.

#### DIRECT INHALATION OF $\text{CO}_2$

*Experiment 6.* As before, the abdomen was opened under ether anesthesia and a uterus containing three fetuses, approximately at term, was disclosed. The uterus was opened, leaving the membranes intact, according to the method already described. A stream of  $\text{CO}_2$  was then run from a tank into the ether inhaler and after twelve seconds active fetal movements began similar in nature to those already described. All three fetuses showed the phenomena about equally but the movement usually were not simultaneous in all. As the cyanosis and dyspnea of the mother increased the frequency and tenacity of the fetal movements likewise increased. In this experiment there was noted an occasional rather slow movement of the extremities which resembled the gliding movement described by Ahlfeld.

*Experiment 7.* Performed in manner identical to Experiment 6 except that stream of  $\text{CO}_2$  was run into the inhaler both before and after opening the uterus. The results under both sets of conditions agreed so closely that it was apparent that the method involving the opening of the uterus as not in itself an important factor in the production of the fetal movements. In this experiment, also, the uterus contained three fetuses.

#### CONTROL EXPERIMENTS

In order to determine the influence of the operative manipulation including such factors as cooling, drying, etc. three experiments were performed in which no operative manipulation was done.

*Experiment 8.* Under light ether anesthesia the trachea was occluded by pressure. With the onset of cyanosis and dyspnea active jerky movements of the fetuses could be seen through the unopened abdominal wall. They agreed closely with those already described, although, of course they could not be analyzed so accurately. They could be easily distinguished from peristaltic waves.

*Experiment 9.* A repetition of the preceding experiment. The results obtained were essentially the same as those mentioned under Experiment 8.

*Experiment 10.* Active violent fetal movements were produced on four occasions during pregnancy by the direct inhalation of  $\text{CO}_2$ . The gas was administered at intervals of about four days apart. At each time it was given for a period of about ten minutes, without anesthesia or any other manipulation than merely fastening the pig to a board. Although no laparotomy was made, it was very easy to distinguish the violent jerky movements of the fetuses in various parts of the abdomen so that there seemed to be no doubt that the whole litter was equally affected. Within twelve hours after the last inhalation of  $\text{CO}_2$  a litter of four pigs was born during the night. When found in the morning one pig was dead, but the other three were active and normal in every respect. The room was very cold during the night and it is possible that the death of one of the pigs was largely due to exposure. This experiment shows the interesting fact that it is possible for a healthy litter to be born within a few hours after enduring violent respiratory movements *in utero*. It is clear then, that the amount of fluid separated into the lungs by fetus undergoing respiratory movements is negligible. Otherwise these pigs could not have breathed normally and lived after birth.

*Experiment 11.* This experiment was performed to determine whether the factor of breathing chilled air was important. The experiments in which inhalation of  $\text{CO}_2$  was used since it is well known that stream of  $\text{CO}_2$  will produce marked lowering of temperature. Violent fetal movements were produced by causing pregnant guinea pig to inhale  $\text{CO}_2$  and the temperature of the inhaler into which the gas was passing was noted at C. The pig was then allowed to breathe air at a temperature of C for the same length of time but no fetal movements occurred.

#### SUMMARY

Asphyxia of the fetus of sufficient grade will result in the production of fetal movements more or less severe. The movements

thus produced vary from mere attempts at respiration sometimes resembling the foetal hiccup of Merriam, to more general muscular contractions simulating the general convulsions of  $\text{CO}_2$  poisoning seen in the adult. At times these are sufficiently violent to be seen through the abdominal wall as distinct shocks. All of the generally recognized varieties of foetal movements, except those concerned with swallowing and sucking have been produced experimentally by methods which induced an asphyxia of the foetus. The intra uterine respiratory efforts are not accompanied by an aspiration of any appreciable

quantity of fluid into the lungs and hence are not incompatible with life after birth. The explanation of this is not clear but probably the contact of the skin with the air is an important factor in opening up the respiratory passages. The hypothetical intra uterine rhythmical respiratory movements of Abbeid (physiologische intra uterine Athmungsbewegungen) were not observed. The respiratory is made that the various active movements of the foetus experienced by many pregnant women in the latter part of pregnancy are expressions of a more or less severe, but usually transient, asphyxia of the foetus.

## MASITIS LACTANTIA

### ETIOLOGY, BEHAVIOR, TREATMENT AND SEQUELAE

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IT is of the very greatest obstetric, pediatric, and surgical importance that the general practitioner as well as the specialist, give the most careful study to the predisposition to etiology and behavior of the infections of the nursing breast in order that they may the more carefully carry out both ante partum, and post partum prophylaxis as well as intelligently and promptly institute the necessary radical surgical measures when unavoidable infections do occur and thereby avoid those changes in the milk secreting acini, ducts, and intra acinous connective tissue and stroma, which not only may inhibit the lactations function and jeopardize the life of the present and indeed successive infants but which also may jeopardize that of the mother from sepsis as well as perhaps later predispose the breast to malignant growths.

The human mammary lie normally between the third and sixth or seventh ribs and between the parasternal and anterior axillary lines bilaterally and are very highly organized, interfacial, rete malpighian glands belonging to the sebaceous type, which have

attained the dignity of milk-secreting mammary glands composed of radiating, grape-bunch-like ducts and peripheral acini, separated from each other by a (lat binding) interadnons connective tissue stroma, in which lie the nutrient blood vessels, lymphatics and nerves of the milk acini.

Under the stimulation of pregnancy these glands gradually undergo increased stroma loosening vascularity lymphatic development, and hypertrophy and hyperplasia of, and colostrum secretion by the acini cells in order after labor to actively secrete milk if nursed, to still sustain the child (parasitically) for a period of time about equal to that which the child was carried in utero when they again undergo involution, though never entirely to their multiparous condition.

The terminal (peripherally situated) active acini are lined by a single layer of large, round, or cubical milk secreting epithelial cells while leading from these terminal acini fine ducts lined by a cylindrical epithelium, debouching (proximally) into the intra- or twenty main ductal galactiferi, which widen in a slants like manner just before opening

on the surface of the centrally situated nipple surrounded by its pigmented areola, with its five to fifteen Montgomerys and many ordinary sebaceous and sweat glands.

Inflammations during nursing in the mammary gland region may be primarily

(a) *Supra mammary* by infection gaining access through some superficial skin abrasion over any part of the breast outside of the nipple region, or

(b) *True mammary lactation infections* which are either *primarily endoductal and intra acinous* from bacteria deposited on or resident in the nipple skin without or with nipple abrasions or fissures or indeed, from bacteria gaining access to or already resident in the milk-ducts themselves (just as occurs so frequently in the ducts of the lower grade sebaceous glands in other regions) or *primarily extra acinous* from the infected nipple atria via the radiating interductal and interacinous stroma lymphatica

(c) *By contiguity* e.g. from a primary infection in the axillary glands extending to the mammary gland periphery or a vertebral (contouring along the rib) or subadjacent primary rib or sternum (often tubercular) osteomyelitis or empyema necessitatis also direct retro mammary infection when giving salt solutions under the breasts

(d) *Hæmologous* e.g. in mumps, cryptogenic, metastatic, or pyæmic (Those occasional spontaneous breast disturbances in the new-born as demonstrated by Koelliker and the cases of real mastitis neonatorum formerly so common, due to the traumata of squeezing for witch's milk by poorly instructed nurses and midwives, which happily occur much less frequently to day also the cases of furunculosis and supra and true mammary infections both during the developmental activity and irritation of puberty or during menstruation or pregnancy or in diabetics (Cameron) perhaps likewise often from contact infection or trauma as occasionally seen in factory workers, who lean on benches or work tools, and erysipelas do not come within the scope of this paper)

The *nursing breast* subjected as it is to the hyperæmia of suction and to the traumata of the child's mouth is very liable to the pos-

sible occurrence, and contact infection of abrasions or fissures, especially common at the apex and base of the nipple, often perceptible to the naked eye and even bleeding

These very dangerous abrasions most commonly occur in the unprepared nipple-skin of primipare and indeed occasionally if less often also in multipare in the first few days or weeks of nursing, possibly consequent on little subepidermal traumatic hæmorrhages being followed by excoriations, or the constant wetting and "imperfect" drying giving rise to a rhagadous eczema.

These nipple lesions are also however very frequently so minute and invisible as to cause no suspicion of their presence in the early stages, except perhaps for some slight smarting pain at the beginning of each nursing, and even this pain frequently lessens or even disappears within a few minutes after the often apparently healthy nipple becomes "warmed up," as it were—thereby giving undue popularity to the term *simple stagnation mastitis* as used by von Angerer and others for stagnation of milk as the only cause is refuted by the rarity of breast abscess in non nursing primipare and multipare. Neither does the occurrence of an abscess as reported by Williams in an unpredisposed multipare who had already reared five children without infection, but in the eighth month of the sixth pregnancy suddenly develops a mammary abscess prove the absolute absence of contact infection or trauma or both

In consequence of this lessening or disappearance of pain, even the mother considers it a natural accompaniment to nursing and unless specially questioned does not complain, till the stagnant milk in the insufficiently emptied and lactei (due to the pain and acute paraductal congestion and infiltration) in stes endoductal infection either by the bacteria in the skin or on the nipple abrasions or indeed those gaining access to or already resident in the ducts themselves

Staphylococci (albus) were found in 60 to 94 per cent of all breasts they played a harmless rôle in the milk ducts in health but became pathogenic under the change of conditions caused by milk stagnation or

paraductal congestion (Williams, Bumm, Hoenigsmann, Koestlin)

The writer would suggest the possible lack of breast-duct resistance to this (oft present) coccus in some primiparae who apparently develop infection almost immediately the child is placed at the breast, much the same as often occurs in cases of stubborn furunculosis in other parts of the body which occasionally have their origin in the hyperemia caused simply by a brisk rubbing of the skin, and the protracted course of which often subdues only after the use of autovaccines.

*Endoductitis* and *ductitis mammae* probably vary widely in their behavior and sequelae according to their extent and severity e. g. if very mild it may probably only cause some slight (large) duct epithelial irritation. In more protracted and acute cases the infection may reach the finer ducts or even the acini and the infection and infiltration invade secondarily the intra-acinous loculi septa.

The study of microscopic sections convinces the most skeptical of the undoubted occurrence of a primary endoductal infection and primary endo acinitis, by the marked involvement of the intra acinous septa and the often entire non-involvement of the interacinous stroma.

On the same alide, side by side, one may find perfectly healthy acini with clear-cut cubical milk-secreting cells and other acini with apparently an increase of cells, which stain much less sharply while the intra acinous septa between the infected acini loculi are thickened and small cell infiltrated and again others in which the intra-acinous septa are so markedly small cell infiltrated and thickened that the acini-loculi are difficult to discern indeed under the low power the acini have almost the appearance of a mass of small infiltrating cells only while the main (interacinous) gland stroma itself is often entirely uninvolved, except for some spots of periductal infiltration here and there.

If resolution of the intra acinous infection should now occur it is very possible that the intra acinous connective tissue septa induration and thickening might give rise to a circumscribed or diffuse "interstitial acinitis"

as noted by Mintz, with atrophy of the milk secreting acini and entire loss of their milk secreting function, or if the acini epithelium be markedly multiplied to the mastitis chronica cystica (Koenig) or "maladie cystique de la mamelle de Reclus," said to be most common in the non nursing-para, or in the advanced stages even to that varied combination of changes which result in the so called adenofibroma, which has been paraded under such a multiplicity of names, because of the preponderance of new-growth being in one case in the ducts and another in the acini epithellum and still another in the sarcoma like multiplication of the connective tissue.

It is also very simple to understand that in other cases where the infection had only slightly or indeed not reached the acini that there may occur either due to the predominating paraductal connective-tissue indurations thickening and duct distortion, or following an actual loss of duct epithelium with ulceration in the ducts, a duct stricture or even atresia with the formation of the rare retention cysts or galactoceles with their oily or butter like contents.

In contra distinction to the foregoing as infection of the (open) nipple abrasions and fissures may be followed by a primary radiating lymphangitis and primary small-celled infiltration of the interacinous connective-tissue or main gland stroma and only if severe or long continued, some secondary effect on the acini and duct epithelium, indeed von Angerer believes lymphangitis the most frequent.

The end result in severe breast infection, whether beginning as a ductitis, probably most often staphylococcal, or whether beginning as a lymphangitis, probably most often streptococcal, is often abscess.

Williams, quoting Rubella, mentions the staphylococcus, either aureus or albus or both, as present in fifteen (93 3/4 per cent) and streptococcus once (6 3/4 per cent) in sixteen cases of breast abscess, and also says that Sargent demonstrated the gonococcus in one case.

If there be a parental or nurse gonorrhea present, even though there be no gonorrheal ophthalmia or stomatitis neonatorum, the contamination of the nipple with gonorrheal

infection, with its predilection to affect cylindrical epithelium-lined ducts, might easily occur in the breast and indeed also prepare the soil for mixed infections.

The writer has also repeatedly noted the concomitance of abscess in the mother's breast and thrush stomatitis of the nursing infant.

From clinical observation there are also cases of apparently synchronous ductitis and lymphangitis.

Of the mammary abscesses 15 per cent are in the non pregnant, 5 per cent in pregnancy and 79 per cent in the nursing woman (Bill roth) and of these latter 67 per cent are nursing primiparae. They vary so extremely in site and behavior that they demand a special description.

(a) The supramammary abscess is really an intersuperficial fascial abscess (i.e. it is situated in the connective tissue and fat between the superficial superficial and the reflected deep superficial fasciae. These superficial abscesses do not involve the gland substance unless neglected, when they may rupture deeply through the deep layer of superficial fascia into the para-acinous connective tissue or infection of this latter occur via the paravenous lymphatics or septa and give rise secondarily to a true mammary abscess usually however the supramammary abscess allows of easy and early recognition and also due to its early tendency to point and fluctuate, is incised promptly.

(b) The true mammary abscess whether primarily from duct or primarily from lymphatic infection or both should include the nipple periductal (areola) and para acinous abscesses. The foci of suppuration are often multiple later becoming confluent forming one large abscess. It usually involves one section of the breast, most often in the external aspect.

In one multipara (seven months after labor) with large bilateral abscesses operated by the writer at the Presbyterian Hospital the abscess of the right breast was on the axillary aspect and that of the left breast on the sternal aspect possibly due to the irregularity of the eruption of the child's teeth causing the abrasions.

The increased looseness of the stroma in the nursing breast makes small-celled infiltration less capable of walling in and limiting the abscess area consequently these lactations abscesses dissect with increased ease both peripherally and proximally and superficially and deeply in the para acinous connective tissue and easily become confluent and often of large size.

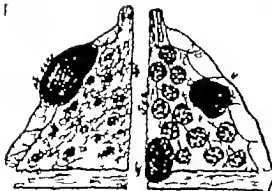
The adjacent milk-secreting acini over a more or less wide area may undergo necrosis, or with the ducts be laid bare, and pus rupture into them and be in part discharged on the nipple though it should be always borne in mind that this pus is not always from an abscess, but may have its origin in the ducts themselves, probably lending to the erroneous impression of Knansberg that he cured mammary abscesses by milking the infected breast.

The axillary sub- and supraclavicular glands are usually also metastatically enlarged and tender and in neglected cases may suppurate and rupture with multiple axillary fistulae. Also that gland suppuration can follow nipple infection, even though no mammary abscess occur should always be thought of as a possibility.

The depth of the true mammary abscess focus in the interacinous tissue also varies. In one case it is comparatively superficial, giving rise to an early superficial tumefaction, redness, and fluctuation, by the infection passing upwards via the paravenous lymphatics or septa or rupture through the reflected superficial fascia to the skin with pointing and if neglected perhaps rupture externally.

In other cases the original pus focus is so deeply situated in the para-acinous connective tissue that, while there may be some slight increased local temperature and pain and even some appreciable hardness in a part of the breast, there is at least at first, no apparent tumefaction or even redness, and palpation elicits no fluctuation.

In these cases a chill followed by a temperature of 103 or 104 F and very frequent pulse, with high leucocytosis early in the puerperium may so uncomfortably simulate puerperal sepsis, especially if there be some tenderness to pressure over the hypogastrium.



(a)

(b)

Fig. Scheme of suppurative breast showing anatomical box, the deep layer of reflected superficial fascia. The mammary gland is not involved.

Fig. Scheme demonstrating endocarditis, ductitis and primary abscess, abscess (a) breaking superficial and (b) breaking retro-mammary.

as to cause neglect to examine the breast carefully.

This unfortunate neglect to diagnose and early incise radially the deep mammary abscess may result in deep paravenous metastasis or deep rupture through into the loose retromammary para connective tissue when the mammary gland as a whole usually becomes more prominent on the thorax being raised by the retromammary pus, which may become very large in amount especially when containing (as the writer not infrequently experienced in cases entering Cook County Hospital) gas containing pus probably due to colon bacilli.

The pointing of these retromammary abscesses often occurs late and usually at some dependent part frequently the lower aspect of the breast periphery but naturally should under no circumstances be waited for.

The treatment especially of primipara prophylactically during pregnancy includes very thorough daily soaping of the nipple and breast with green soap to soften the often extremely thick dirty bacteria holding duct mucus obstructing horny layer of nipple epithelium the very thickness alone of which hinders the free flow of milk and will later cause cracks—if they occur—not gape and so interfere with the healing process.

A wet boro-salicylic dressing occasionally at night in which the impervious covering extends at least one and one-half inches beyond the wet dressing all around, aids materially in the softening and cleansing process.

(Alcohol to harden the nipple should be used sparingly if at all it dries and hardens the horny layer too much.)

The nipple should also be well pulled out nightly by the patient herself after the fifth month of pregnancy using gradually more and more force in the pinching and pulling and so prepare it the ducts, and the breast for the trauma of nursing as well as thereby improve their strength and circulation.

The post-partum prophylaxis is regular interval nursing for a consistent length of time only followed by immediate washing off with watery boric solution or other antiseptic and thorough drying and covering with an aseptic pad and keeping warm.

The routine antiseptic care of the child's mouth is also very essential.

The beginning of pain or smarting immediately when placing the baby to the breast or the application of the alcohol test, should be followed at once by the application of wet antiseptic dressings to be renewed every two hours and the nursing be conducted through an aseptic shield.

The removal of the child entirely is necessary if the condition does not respond to treatment or if there be other signs of abscess formation and one or more early long radial incisions according to the number of loci in the affected breast with the evacuation of the pus, curetting and iodination and iodoform gauze packing or pinned drainage tube inserted. In one recurrent case Dr. V. Spratt Heaney actually discovered a healed drainage tube.

If the finger (inserted in the wound) passes into the retromammary space a pair of forceps should at once be inserted behind the breast and a dependent transverse incision and drainage made at the lower periphery.

The absence of this latter (often extremely necessary) precaution accounts for many of the very protracted cases with the formation of multiple pus and often also milk abscesses.

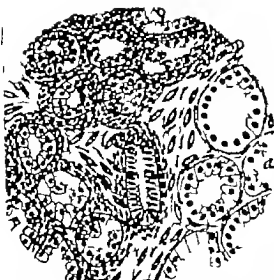


Fig 3. Drawing from microscopic section of ductitis and acinous mastitis. (a) Healthy acinus. (b) Acinus with small cell infiltration of the acinus lobule septa and interlobular para-acinous tissue. (c) Karyocell lined duct surrounded by small cells. (d) The crusty area is uninvolved and healthy even here even because the affected acinus (b) (b).

ing fistulae and often almost total breast destruction with burrowing under the pectorals perhaps involving the ribs and into the axilla or even under the latissimus dorsi demanding dependent drainage in the posterior axillary line with or without removal of the axillary glands.

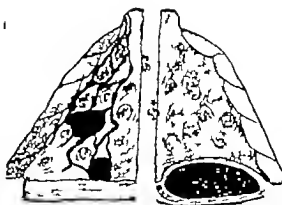


Fig 3

Fig 4

Fig 3. Schema of radiating lymphangitis mammae in which the ducts are uninvolved except for the terminal acinus. (a) superficial mammary ducts breaking superficially. (b) deep abscess breaking retro-mammary only.

Fig 4. Schema of primary retro-mammary abscess with crowding up of the ducts of unaffected breast tissue.

Besides the local infection indeed, septicaemia or pyaemia may result with lethal issue in neglected cases.

Recovery of extensive loss of breast tissue is by granulation tissue the resultant scar often together with the surrounding induration and indeed possibly deposit of lime salts may simulate or later be the site of origin of mammary carcinoma, thereby justifying the proposal to amputate the breast after the healing has occurred in cases of panmastitis.

## CHRONIC PERFORATION OF PEPTIC ULCER

REPORT OF FOUR CASES<sup>1</sup>

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**A**N ulcer of the stomach or duodenum may perforate in several ways. There may be typical acute perforation with characteristic symptoms of sudden agonizing pain followed by boardlike rigidity, peritonitis, and death if operation is not performed within a few hours. This condition is most apt to occur with ulcer of the anterior surface of the stomach.

There may be also subacute perforation with formation of an abscess cavity surrounded by adhesion. This occurs most frequently with ulcer of the posterior surface of the stomach or of the duodenum.

There may also occur what has been variously termed pinhole perforation, occult perforation, or penetrating ulcer in which the ulcerative process has extended through all of the coats of the stomach but in which perigastric adhesions have occurred so quickly and firmly as to at once plug up the opening which is usually small.

This includes the main classes of perforated ulcer though there are various other results which may ensue from these conditions after a variable length of time as burrowing of an abscess, subphrenic abscess, perforation into another organ, subcutaneous emphysema, etc.

I report four cases of non-acute perforation which are of interest for several reasons. Three of these patients were seen within a period of three weeks. Two were of the occult perforation type and two were typical chronic perforations. By the term chronic perforation we mean the condition which obtains when an ulcer perforates acutely but in which death does not occur though operation is not performed at once and in which the perforation still exists unhealed.

Diagnosis was correctly made in three patients before operation and in two before the radiographic examination. The radiograph showed free air in the cavity outside of

the stomach in but one of the three cases submitted to X-ray examination.

All four patients recovered. It is most unusual for any four consecutive cases of perforation to recover without immediate operative intervention. Riegel says: "As a rule, perforation, with the passage of gas and stomach contents into the peritoneal cavity leads to death in a short time. Occasionally, however, perforation seems to heal even though symptoms are exceedingly violent in the beginning. Such a cure, however, is rare and is seen only if perforation occurs when the stomach is empty." I saw a case of this kind some time ago. The patient developed all symptoms of perforation into the free abdominal cavity. Hepatic and splenic dullness disappeared and there were severe meteorism, collapse and other symptoms. The patient recovered completely.

Hall has gathered six other cases of a similar character from the literature and had one case.

The histories of my patients will be presented in their chronological order.

**CASE 1.** Mr. W. T. G. was seen July 9, 1914. He had a history of digestive disturbance extending over considerable number of years consisting of pain coming on four hours after meals and relieved by eating. He had been seized at rising in the morning with severe abdominal cramps at first in the epigastrium and spreading over the whole abdomen followed by vomiting. His temperature as normal and the pulse as to and of good quality. There was moderate rigidity and general tenderness not localized to any one point. A perforated ulcer was at once thought of because of his good general condition and because of much shock. The possibility of simple enterostoma was considered and he was given morphine, one-fourth grain repeated in thirty-five minutes partly to relieve the intense pain and partly as diagnostic measure since it can be said that any habitual cramps which are not relieved by one-half grain of morphine has an organic cause, usually surgical and are not due to simple enterostoma.

Continued. 384.



Fig. 1. Case 1. Perforation of gastric ulcer. A Spot of barium above lesser curvature cavity of the perforation in gastrohepatic orientation. B Partial hour glass constriction. Not complete left sided position of stomach and pylorus.

Two hours later the patient was again seen and was no better. The cramps and vomiting continued. The abdomen was quite rigid, pulse was good though the temperature was normal and the face was pale and covered with profuse perspiration. His leucocyte count was 10,000 with about 90 per cent polymorphonuclears.

A positive diagnosis of perforated duodenal ulcer was made and occurred by Dr. C. S. Whit. He was at once moved to the hospital for operation but another leucocyte count immediately after admission showed no increase and as his symptoms appeared slightly less marked, it was thought that the perforation which was becoming automatically sealed up by adhesions. It was therefore decided to postpone operation and have blood counts made every hour.

The patient improved and was put upon medical treatment for ulcer which was shown by occult blood and other tests to be present. After one month treatment he was apparently well and has had no recurrence.

This is the only patient in the series in whom diagnosis was not proved by radiograph or operation, but there can be little doubt as to the correctness of the diagnosis.

CASE 3. M. G. L. W. age 55 was referred to me by Dr. Robert Trimble. December 20, 1935, complaining of pain on the left side of the epigastrium running down and pain as if the testicle were

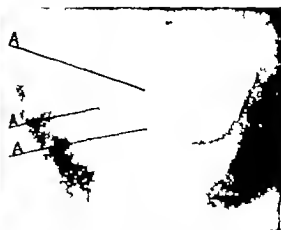


Fig. 3. Case 3. Chronic perforation of duodenal ulcer with abscess formation. A, A', A'' Areas of non-filling and irregular filling due to distortion by dense adhesions. The perforation does not show but under fluoroscopic examination all this part as removable and there is enlargement of liver from congestion. Diagnosis made before operation.

being pulled on. In addition to this pain under the costal border he had hunger pain in the mid-epigastrium before meals and at night and this pain was always relieved by vomiting. There were indigestion, acid water-brash, bloating, etc. These symptoms were of four years' duration and during that time he had lost twenty pounds. The patient was very ill looking man with almost a cachectic appearance. He had a marked myocarditis the pulse being in the eighth interspace, irregular line of a clock character and intermittent badly.

The abdomen was scaphoid withritable recti. The splashing sound was confined to the left side of the abdomen not even extending to the midline. There was point of tenderness in the mid-epigastrium and no other very markedly tender spot in the left hypochondrium just below the border of the ribs. There was a feeling of an indefinite mass in the upper epigastrium.

The test breakfast was not given, but examination of the vomitus showed free HCl 36 and total acidity 46 and there was one particle of food taken twelve hours before. Occult blood was faint in both stomach content and the stool.

A diagnosis was made of ulcer of the stomach and he was put to bed but pain and vomiting persisted so that it was necessary to radiograph him several days later. Radiographic examination by Dr. A. C. Christie showed that the stomach was fixed in position and tilted to the left side of the abdomen. There was a partial hour glass constriction with a spot of barium above the stomach, separated from it by fixed in position and constant in all pictures and under the fluoroscope which showed that this point exactly corresponded to the tender point (Fig. 1). Diagnosis was made of ulcer of the



Fig. 3. Case 4. Hour glass stomach with perforation of greater ulcer. A perforation of ulcer and perforation. B complete hour glass constriction.

less, very true with hour glass constriction and chronic perforation.

Close questioning brought out the fact that in months previously while this ill he was suddenly thrown to the floor with violent abdominal pain and became hysterical. Six months later he was hospitalized as administered treatment. He was thought to have a perforation and the next day was able to return to his office but this complicated the time of the perforation.

Operation by Dr. C. S. Whit disclosed and treated ulcer on the lesser curvature the size of egg. The hour glass constriction and perforation of the gastropyloric area. Adhesions were so dense that they were not disturbed and it was impossible to do anything other than gastro-tomy, high up, but the constriction. The patient made a remarkable recovery and has gained considerably since the operation.

Case 3. M. A. I. Kirk. Age 40. Consulted me December 6, 1913. His health had been good 11 months before he began to be poorly at night hours. He had often awoke at night.

On December 7th his work he was suddenly seized with vomiting and abdominal ramps so severe that he could not move. He was taken to the Emergency Hospital and after 2 days moved to his home. He had improved somewhat from that time but had constant soreness in the right hypochondrium and tenderness over the liver. He had lost eight pounds.

At the time that I saw him he appeared ill. The abdomen was scaphoid with rectus tense and irritable. There was a point of decided tenderness mid the border of the ribs on the right side, in the region of the gall bladder. There also seemed to be some tenderness all over the region of the liver. There was no occult blood in the feces or stomach contents which showed free acid 74 and total acidity 88. Leucocyte count was 13,300.

A perforated duodenal ulcer as the first diagnosis but it was then thought that he had cholecystitis because of the location of the tenderness in the leucocytes, and the absence of occult blood.

He improved to a certain point and even returned to work one day but then lost ground and on January 5, 1914 three weeks after the acute onset, I returned to my first diagnosis of chronic perforation and admitted him to Dr. Christie for radiographic examination.

The stomach in this case also as found to occupy a decided left sided position and was fixed. The liver was seen to be considerably enlarged and congested. While the perforation did not show there was not a marked defect and irregular filling of the whole pyloric antrum and first part of the duodenum (Fig. 2).

Operation the next morning by Dr. Winter revealed masses of dense adhesions between the gall bladder pylorus duodenum and lower border of the liver enclosing large masses due to perforation of duodenal ulcer. A gastro-enterotomy was performed and the adhesions easily divided. For some time he was very anemic from the large amount of pus which formed, but he quickly and apparently perfectly recovered.

Case 4. Mrs. A. O. age 36 as referred to me December 9, 1913 by Dr. Leon Martel. She had been troubled with her stomach for 15 years, her chief symptoms being gas in the stomach and bowels, flatulency, attacks of headache and vomiting. She had attacks of vomiting lasting several days but usually the attack seemed migratory in character, the vomiting relieving the headache. She had occasional pain but with no regular and not colic or cramp-like in character.

On examination she was found to be fairly well built and healthy looking. Examination of the abdomen except for the following points. The right kidney was palpable about 1 inch below the costal border and slightly tender. The abdomen was well formed with normal rectus. Spinal fluid was obtained over the upper half of the epigastrium only. There was slight tenderness over the whole epigastrium and down the right side of the breast which appeared thickened and was plainly palpable. A small localized and very tender spot as found on the left side in the nipple line 1 1/2 inches below the level of the elbow.

The urine contained very faint trace of albumin. Hyaline casts and faint excess of indican. There was no occult blood in the stool. One hour after test breakfast only 10 cc. of thick content were

obtained with considerable excess of mucus and free HCl 40 and total acidity 30.

Ulcer was considered but ruled out because of the absence of occult blood, the character of the stomach contents, and the absence of any very positive symptoms or signs. Diagnosis was made of chronic constipation with acid gastric catarrh, migraine, and nephropathy.

She was put on treatment and daily lavage instituted. There was a quantity of mucus and considerable food retention found at each washing. She improved subjectively at once and had no more headache or vomiting, but at each lavage there was just as much retention as at first so that it was evident that she had some obstruction though the rice and mucus test was negative. No radiographic examination was made January 2, 1914 (fig. 3). There was revealed an almost complete hour-glass constriction of the stomach with a large ulcer on the lesser curvature which was so saturated that its outlines could be seen in some of the plates.

Operation as advised and in view of the location of the ulcer high on the lesser curvature it was determined if possible to cure the ulcer. The operation was performed January 9, 1914 by Dr. W. H. H. and the findings exactly as indicated by the radiograph. There were dense adhesions about the site of the ulcer and as there were several perforations as disclosed nearly large enough to admit the tip of the little finger but which did not firmly seal up. A consider-able part of the lesser posterior of this opening still

ulcer. An incision about two inches long was made along the lesser curvature then extended backward and the ulcer excised and stomach closed. A gastro-gastrostomy was then done but it was feared that this might not give enough of an opening, so nearly the whole of the anterior surface of the stomach was divided and reunited so as to give clearance of a couple of inches.

The patient made a beautiful and eventful recovery without any evidence of shock, in spite of the magnitude of the work done on her stomach. She has not been completely relieved of her symptoms yet and a radiograph made March 9, 1914, showed there was a spastic contraction at the site of the old constriction. Under the fluoroscope this spasm was seen to relax 4 times. It has not been decided as yet whether the spasm is due to a recurrence of the ulcer or not but there is no occult blood to indicate such condition. She has been put on cream diet with Atropine and if this is not productive of good results it may be necessary at some future time to do gastro-enterostomy high up above the constriction.

Chronic perforation the type of termination of ulcer represented by these four patients is so very rare that it has been thought advisable to place their histories on record.

These patients then report I have had 4th case of chronic perforation, could advise that he can do so in more cases than has been reported but I have not as much experience.

## OBSERVATIONS OF INGUINAL LIPOMATA BASED ON 154 HERNIOTOMIES

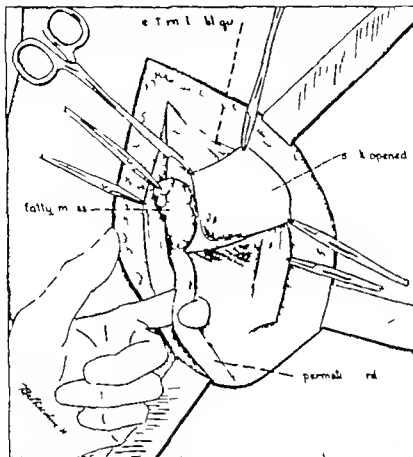
By KATHARINE SPEED AND CLARA

SOME time ago L. W. Andrews in demonstrating his umbrella operation for hernia suggested that the inguinal lipomata found so often in some two thirds of the cases of the true inguinal bulgings were of importance as a causative factor of hernia primarily and if not removed were a factor in recurrence. This fact had noted before in his article on hernia in the American Textbook of Surgery but not emphatically and this literature has a reference to the role of lipomata in hernia. It was considered of enough importance to warrant the selection of 154 cases for study looking toward determining if the frequency of these fatty masses and their

relative size and position and this article desires to call attention to their presence and advise their removal in all inguinal herniae by ligation a high up a the sac cut off.

If left behind even in trans-plantation of the cord regardless of the type of operation used to cure the hernia they tend to cause a bulging of the inguinal canal and a part of the preperitoneal fat being attached to it they are subject to some downward strain in increased abdominal tension from any cause and exert traction on the peritoneal surface at or about the internal ring. This traction may cause the formation of a true hernia and give a recurrence following operation for radical cure. Personal observation has been





Schematic diagram drawn from actual operation illustrating inguinal canal opened, sac dissected from cord and opened and separated fatty mass extending down into internal ring.

than thin individuals as they have a greater amount of preperitoneal fat but the lipomata are also found with great frequency in those of normal or even a subnormal amount of adipose tissue.

In herniotomy perhaps too little attention is paid to freeing the sac neck around the internal ring for a distance of one to two cm after it has been freed from the cord tissues. The sac should be held up taut and the index finger gauze covered should sweep well around the internal ring freeing the sac neck which the constant pull stretches further out into the wound. If ligated as in the ordinary run of cases, the ligature should always be deeper down—i.e. nearer the abdomen—than

the white line of the old thickened constriction ring which is present in practically every sac. In making this freeing dissection around the sac neck and pulling it down, one often brings into view hidden lipomatous masses, possibly of very broad base lobulated and as a rule pointed out from the internal ring and the general direction of the cord. These can be included in the ligature and removed even if the sac neck has to be further dissected up to get to their base. The amount of time involved is small and the peritoneal surface is sufficiently elastic to allow much stretching. If they remain, or if the sac has been tied off too long with a tendency for the peritoneal surface to bulge out from the internal ring

Instead of being well retracted back and offering no depression into which omentum or other abdominal content may tend to wedge these masses of fat become larger are inclined to slip or wedge into this small ex-

trusion and cause gradual recurrence of the cured hernia.

Of 154 herniotomies performed, lipomata were found present in the opened canal 73 times, giving a percentage of 47.4

## CONCERNING THE FORMATION OF A NEW VAGINA IN THE CASE OF CONGENITAL VAGINAL MALFORMATION

B. D. GOTTHARD SCHUBERT, GYNECOLOGIST, BELTREN, UPPER SILEZIA

ALTHOUGH only a few years have elapsed since the first experiments were made in trying to form an artificial vagina for those individual that are affected with congenital vaginal malformation the literature concerning this subject has recently increased considerably. It was Kromer (1) who critically examined the literature existing up to this time and wrote his essay, *Die plastische Neubildung der Scheide bei partiellem oder totalem Defect*. I may be permitted therefore to pass over methods which up to this date were used to correct this deformity. I shall confine myself to a description of the development of this young branch of surgical gynecology.

Originally there were employed pedunculated cutaneous flaps cut out of the upper thigh or the small labia (of the vulva) for the purpose of lining a canal which was formed (without cutting) between the rectum and the bladder and which represented the new vagina. Some surgeons used peritoneum, others employed pieces of the skin (which were transplanted from any convenient place) for the purpose of lining the cul de sac. Even the intestinal mucous membrane of rabbits was employed for the same purpose. But all these methods failed to obtain any practical result, inasmuch as the transplanted pieces of skin soon shrunk and the artificial canal was gradually occluded.

Matters began to go the right way from the very moment when mucous membrane was employed for the purpose of lining the artificial canal. Gersuny (2) was the first to try an experiment of this kind. The canal

which was to represent the artificial vagina was lined with a piece of mucous membrane which had been cut out from the rectum. He proceeded in the following manner: After having divided the perineum and the sphincter ani he cut a strip of mucous membrane from the anterior wall of the ampulla without interrupting its connection with the rectum near the plica veno-rectalis. This piece was then laid on the back wall of the bladder as far as the orifice of the urethra and here fixed by suture. The wound which was thus caused in the ampulla was closed by three rows of sutures, the margins of the wound having been loosened. The anterior wall of the artificial vagina was thus formed by a piece of mucous membrane from the rectum, while the surface of a wound like the anterior wall of the rectum which had been united by suture formed the back wall. The sphincter ani was not united lest the strain due to evacuations should interfere with the course of healing of the sutures. A tampon covered with gutta serena paper was introduced into this artificial vagina in order to prevent the tract of wound from cohering. This method was employed in four cases, three times by Gersuny himself and once by Puppel (3). Excepting that his patients had to wear a dilator (a conical vulcanite plug) in order to prevent the vagina from narrowing, Gersuny obtained tolerably satisfactory results. Puppel was not so successful; a rectal fistula and a contraction of the artificial vagina in consequence of tension of the tissue produced a total failure.

There is no denying the fact that Gersuny's

method shows a considerable progress in the formation of an artificial vagina in the case of absolute malformation nevertheless it proved insufficient. The fact that the piece of mucous membrane, which is covered with bacteria is, during the whole length of the operation in continual contact with the surrounding surface of the wound, renders a perna intentio of the suture in the rectum a doubtful thing. It is not to be wondered at that fistule appeared in the cases of Gersuny and Puppel. The permanent wearing of a dilator in the artificial vagina is another detriment which ought not to be connected with an ideal operation. The dividing of the sphincter without its being united by suture is in most cases, connected with a partial incontinence i.e. patients will be able to retain evacuations of an ordinary consistency but neither diarrhoea nor flatus. Last but not least, I do not think a vagina of the above description permanently suitable for coition.

The first operator who employed a piece cut from the rectum for the purpose of forming an artificial vagina was Suggareff (4). He proceeded in a manner which appears monstrous to us. He divided the rectum in the region of the os sacrum the lower end was formed into a cul-de-sac the upper end was attached by suture to the skin thus representing the excretory duct of an artificial anus. According to Kromer's report (loc. cit.) Suggareff divided the bridge between anus and vulva and closed the wound by pulling into the lateral margins (the question is which) thus was formed a kind of channel leading to the piece of rectum which was destined for coition. The leading idea was to prevent from the contact of the external sexual organ for the purpose of coition and to place the entrance to posterior cul-de-sac as far forward as possible. According to this method Suggareff has operated on three patients.

I do not hesitate to criticize Suggareff's procedure in the harshest manner as it brought about a more serious disease than the want of a vagina mean. What a mischief a preternatural anus for him who possessed with it. Aside from this there is no denying the fact that the patient during the

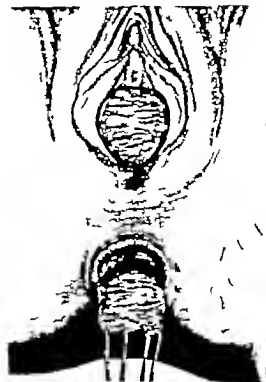


FIG. 1. First stage of the operation. Circumcision of the hymen and preparation of the rectum out of the sphincter and 3 cm. long.

whole length of life must expect serious injury to their health as every anus preternaturalis however deep it may be placed causes serious disorders of the digestive tract. In my opinion there is not a single extenuating fact in Suggareff's procedure that should influence other surgeons to follow his example for concerning the methods of correcting the malformation of a vagina, we should, without Suggareff have arrived at the same stage of progress today as those methods, which properly speaking are the only available ones were invented by men who I do not suppose had any knowledge of Suggareff's procedure.

We have seen that all the methods mentioned above proved absolute failures or brought about only slightly satisfactory results. Beldwin's method was the first to obtain really useful results (5). Having his theory upon experiments on dead bodies, he proposed using a loop cut from the small intestine for the purpose of forming an artificial vagina.

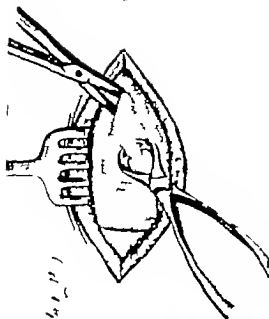


Fig. 1. Excision and extirpation of the rectum.

In 1907 Baldwin tried this method. In one case the vagina of a patient had been contracted by scars in consequence of repeated dystocia, and had thus become unfit for coition. Baldwin cut out the undermost part of the ileum. A Murphy button combined the two ends of the divided intestinal tube, while the dissected piece was formed into a cul-de-sac. By means of a silk thread which was put around the middle of the loop this piece of ileum was drawn into a tube which was formed into a cul-de-sac between the rectum and the bladder; then it was united by suture with the orifice of the vulva and at last opened there. Thus was formed a double vagina, the wall of which was later gradually divided. This operation was crowned by a lasting and satisfactory result.

In four other cases Baldwin proceeded in the same way and was successful in each case.

Without having any knowledge of Baldwin's method, Mori at Ira in Japan in the same year formed a vagina by cutting a sling out of the small intestine but without doubling it. Even two years after the operation the result remained satisfactory (6). In the same year

Haeberlin (7) proposed remedying congenital vaginal malformation by implanting a loop cut out of the small intestine.

This method was employed by the following surgeons: Abadie (8), Priole Loeb Ferdinand (Muller [9]), Stockel (10), Papanicolaou (11), Hulshausen (12) and Bumm (13).

Before critically examining the methods referred to I shall speak of other operations in which also were employed pieces cut from the intestine for the above-mentioned purpose.

Amann (14) used in his case the anterior wall of the rectum. His patient had a rectovulvar fistula. In consequence of stupor. The ampulla recti of his patient being unusually wide Amann by means of intestinal clamps pulled down an upper fold of the anterior wall after having thoroughly divided the bridge between the fistula, the anus, and the sphincter. Then the fold was transversely split and entirely isolated. The upper margin of the wound being attached by suture to the orifice of the vulva, the place of the former fistula now formed the orifice of the vagina, while the lower margin of the wound was united with the sphincter and closed, in this way the divided rectum. By uniting the levatores ani, Amann formed a septum vaginae. Then he united the sphincter by suture and finished the operation by skin-suture of the perineum. The result was highly satisfactory. Amann himself declares that his method is suitable only in the case of a wide ampulla recti. He proposes, therefore, to employ the rectum to form a new vagina in every other case.

A rather complicated way of forming an artificial vagina was chosen by Albrecht (15). He opened the peritoneum in the sacral way, pulled down the flexura romana, closed the peritoneum, divided the flexura at its transition to the rectum, and pulling out the upper end through the vulva, attached it here by suture, finally implanting the upper part of the rectum laterally in the flexura. At first the evacuation made its way *per vaginam*. After a few days, he divided the implanted flexura (which represented the vagina) about 3 cm. above the vulva and united the surfaces of the two wounds by suture.

Albrecht employed this very radical and complicated method in three cases, obtaining a satisfactory result in two. In a third case the vagina became entirely necrotic. This was a fatal failure. Fecal fistula appeared in each of these three cases and had to be closed by a later operation.

Finally one word more about Popoff's (16) method. He employed the rectum for the purpose of forming a vagina by cutting out the ampulla recti and placing it in the region of the vagina, while the upper end of the rectum was pulled through the anal wound and united by suture with the sphincter which had remained entire.

Without having had any knowledge of Amann's proposal, which had not yet been published nor of Popoff's procedure which, even up to this day I know only from short reports (I know only the former methods in which pedunculated patches of the skin or pieces cut from the small intestine were employed)—I say without having had any knowledge of these above mentioned methods I followed absolutely a course of my own in a case which I shall describe (17). I formed an artificial vagina by means of a piece of the rectum, which absolutely answered the purpose. Three other cases offered much opportunity of technically improving my method so that at this moment, if I may say so matters have reached the highest attainable degree of perfection.

I proceed in the following manner. The patient is lying on the right side. I extirpate the hymen completely without penetrating deep into the body then follows circumcision of the anus the dissecting of the rectum from the sphincter (Fig. 1) (about 3 cm long) after a moderate dilatation of the sphincter and, at last a dressing forceps covered with a thick tampon is introduced into the rectum.

I make a cut to the bone (10 cm long) above the coccyx beginning 5 cm above the anus the fascia is pushed aside and the coccyx is laid bare and seized with the bone forceps. On gently raising the latter the sacrococcygeal synchondrosis becomes visible. While the joint of the coccyx is pressed toward the rectum, the synchondrosis is divided with a bone knife. The coccyx is (by means of a pair of

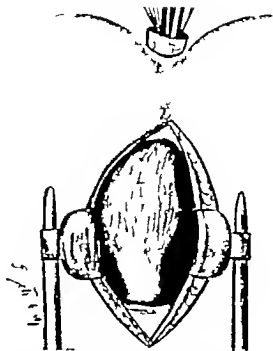


Fig. 1. Showing the rectum pulled through the sacral canal by means of an introduced forceps.

scissors) enucleated. I advance from its point by means of planing the bone. The two terminal branches of the arteria sacralis are held by two forceps. The fascia pelvis is divided by a longitudinal incision. The rectum is pulled forth by means of a dressing forceps and isolated about 12 cm above the anus by means of bilateral ligatures above and below the place which is to be divided. The rectum having been so far isolated that a bridle bandage can be put round it, the rectum pelvium is pulled down. The stretching connecting bundles are doubly tied and divided, until the part which is to be cut through may easily be pulled down toward the anal region. The peritoneum is not opened and remains invisible. Now the rectum is pinched by means of two intestinal clamps, and the intestinal tube is divided between the clamps. The surface of the upper incision is covered with a tampon saturated with lysol, while the lower wound is immediately closed by way of a continuous suture which after the removal of the lower clamp is secured by a double row of button sutures. The cul de sac

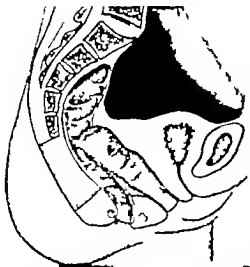


Fig. 4. Showing the general situation respecting the wound and the displacement at the end of the operation.

which has thus been formed is, by means of two sutures fixed as high as possible to the ligamentum sacrospinum. Now I penetrate with my finger through the perforated bymen toward the coccygeal wound and widen this canal so that two fingers can easily pass through it. The anal piece of the rectum which was cut out from the sphincter is drawn through this canal toward the newly formed orifice of the vulva by means of some interrupted sutures fixed to the margin of the skin. The upper end of the divided rectum, which was closed with a clamp is in a similar way put through the sphincter ani, at first by means of some hidden sutures fixed to the sphincter itself and afterward to the external anal skin by means of some interrupted sutures. A thin sterile strip of gauze is put in the coccygeal wound and pulled through the lower corner of the wound. The rest of the wound is closed. The newly formed vagina is laid bare by means of a speculum cleansed from phlegm, and plugged with a sterile gauze swab. At last, at the end of the operation, a drain of India rubber covered with gauze is introduced into the rectum.

Following this method I have operated on four patients. The healing took a regular course without any trouble. The primary and secondary results were excellent. I

never heard of any complaint, either at the end of the convalescence or after many years of observation. This method was employed by Floel (18) by Franqué (19) by Kromer (20) by Straussman of Berlin, and by Engelmann of Dortmund. Nine cases in which this method was employed have been observed up to this time. All these surgeons approve of the simple manner of the excision and report extremely satisfactory results.

If we now compare the different methods which I have described above with my procedure it seems to me evident that my method possesses such important advantages that it deserves to be called the most simple and the best of all. In my opinion there is hardly a possibility of Albrecht's procedure competing with the rectum method. Up to this time there is none who has employed Albrecht's method and I think there will be none, the method being too complicated and its results too problematic. (Remember the cases mentioned above: in one case gangrene of the new formed vagina; in all three cases fecal fistulae.) Thus I think there will hardly be a surgeon found who will follow his example. Concerning the main effect,—a vagina fit for coition—there is only one method which can compete with my procedure: that is the small intestine method according to Baldwin, Mori, and Haeberlin. Respecting simplicity and security of life there is no rivaling my method. Baldwin's method seems to me too dangerous, and I agree with Albrecht, who thinks that Baldwin's method offers too little security of life and that the loosening of an intestinal suture may cause the death of the patient. It happened in the case of Abadie (21) who operated by Baldwin's method that a patient in consequence of an intestinal suture not being tight enough and causing a fecal fistula had only a narrow escape of the most serious complications.

In spite of all our modern procedures in spite of the most brilliant skill in excision, the small intestine method for the purpose of forming a new vagina represents a hazardous enterprise which I should not like to venture. By the loosening of an intestinal suture, very in itself or

only one mistake in the aseptic apparatus under certain circumstances is sufficient to destroy the life which has been entrusted to us. Therefore Stockel (22) is quite right in saying: Who would venture to assert that the discipline of the operation theater is able to render impossible such mistakes in the procedure that may easily become fatal? There is no denying the fact that mortality reaches a higher percentage with laparotomy than with other operations. This incontestable truth cannot be gainsaid; however, excellent the perfection of surgery may be.

Medicinal literature shows a great many operations executed according to Baldwin's method, but these cases do not at all prove that all these operations had satisfactory results. It is nothing but human not to publish those cases which turned out badly. I do not hesitate to confess that even my method cannot afford any proof of it, bringing about only successful results in every future case. But nevertheless, I am convinced that concerning my method nothing but an unforeseen accident is able to cause an unfortunate result. In my opinion there is not the slightest doubt that the small intestine method is connected with serious dangers to life and health which hardly come into question in connection with my method.

I pass over all the casualties and dangers connected with the small intestine method which besides peritonitis appear during convalescence such as thrombosis of the mesenteric vessels or ileus after the operation and, supposing that the operation is always crowned with a satisfactory result, there are nevertheless in this method so many deficiencies that they are sufficient in themselves to cause us to reject the method of forming a vagina by means of a small intestine sling.

The fact that my operation can be executed from its beginning to the end with the patient in a lateral position while Baldwin takes his course at first per vaginam afterwards per laparotomy and finally per vaginam again, — I say this fact shows that Baldwin's method requires much time and endangers the aseptis which circumstances do not prove Baldwin's method to be an acceptable one.

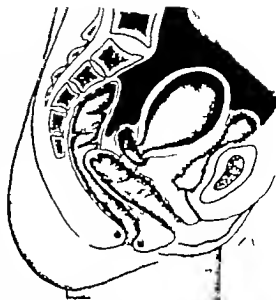


FIG. 5. Displacement of the end of small intestine to form a new vaginal canal (Small Intestine Sling operation).

It may happen that after the opening of the abdomen an extremely short mesentery is found. In this case there is nothing else to be done but to stop the operation and to close the abdomen and all labor is lost. The scar on the abdomen, even if no hernia follows, is an everlasting memorial of this operation not only for the patient but also for her husband. There is no denying the fact that the mesenteric section of which the implanted sling is formed, being very much stretched in itself will cause much pain whenever a stretching of the vertebral column is required by any function. The cord which goes through the small pelvis seems to me a sufficient reason for permanent fear of an ileus. A stricture appearing at the anastomosis of the intestinal loop and which we cannot entirely avoid even by forming a wide lumen may require a new operation or cause lasting troubles. Besides this, the adhesions which in consequence of the operation appear on the mesentery and the intestinal loop very often cause the most disagreeable conditions.

It is known that Stockel, at the end of his operation (Baldwin's method) has succeeded in proving the existence of coli bacteria in the peritoneum. Through experiments it

has been satisfactorily proved that in case the surgeon is not free from germs adhesions will appear in the peritoneum. I am of the opinion that there is no possibility of applying Baldwin's method in the case of high-lying hamatocolpos, in which case the forming of a new vagina for the purpose of restoring the possibility of conception must be for a surgeon a highly ideal aim.

It is undesirable that the thin intestinal wall, which during a colostomy separates the perit from the abdominal cavity, means a permanent and great danger for the possessor. Humm of Berlin (23) covered the intestinal tube with the existing rudimentary anastomosis, thinking to have found a way of diminishing the danger. On the basis of the same apprehension Ruge of Frankfurt has per laparotomy removed a piece of flexura sigmoides which on account of its thick coat seemed to him most fit for the formation of a new vagina. Under these circumstances, the canal being lined with mucous membrane the appearance of hernia lies within the bounds of possibility, which so far as I know none of Baldwin's adherents has taken into consideration.

Injuries to the bladder and rectum are very possible at the canal which has to receive the intestinal tube formed into a cul de sac. What effect the secretion of the implanted piece of skin will have on the exterior genital and the surrounding parts remains to be seen. In order to prevent the intestinal loop from secreting too much Stöckel has prescribed a special diet to a patient who had been operated on according to Baldwin's method.

Without further circumlocution I come to the question, *Is anything all these important difficulties, how does my method stand?* Concerning the scar it is not to be seen, and thus it comes that in two cases the husband has not the slightest intelligence of the correction in the body of his wife. Two months after the operation Knorr (loc. cit.) exhibited to his students a patient who had been operated on according to my method. Kromer's assistant who had been studying for several years, failed to discover the suture at the vaginal orifice and not knowing that an artificial vagina had been found he was of the

opinion that he had seen the diagnostic sign of a catarrh of the cervix uteri. The scar is the rim and is only to be found by one who knows the whole previous history of the scar. Hernia of the scar with all its inconvenient effects I absolutely put out of question, so far as my method is concerned. Likewise we avoid all the damages and dangers brought on by laparotomy because the peritoneum does not come into sight at all. There is no reason why the secretion of the rectum should have a detrimental influence upon the exterior skin as nature itself has destined this piece of intestine to act as an excretory duct. During a two years period of observation, none of my patients whom I have operated on had any cause of complaint in this respect. There is no possibility of injuring the bladder as it is not necessary to form a tract of wound in the region of the bladder for the purpose of implanting the piece of intestine. But now it does not admit of any doubt that in the case of high-lying hamatocolpos or not complicated hamatometra my method offers an excellent way for a lasting discharge of menstrual blood at once promises a fair prospect of restoring procreant power which purpose can hardly be attained by the small intestine method mainly because it would be necessary to open hamatocolpos before the implanting of the intestinal loop. In this case the peritoneum is greatly exposed to the danger of becoming infected which would very much increase the insecurity of the dangerous action. Also in the case of hamatometra it would be necessary to make an opening for want of room.

I am sorry to say that I never had occasion to form a new vagina in the case of the above mentioned malformation. In my opinion the process of operation would be as follows. At first the new vagina is formed out of a piece of the rectum rigidly of the existing hamatocolpos or hamatometra. After the new ascender the hamatocolpos is opened, and by plugging the edges of the wound are prevented from uniting. In the case of hamatometra connected with hamatosalpinx it is necessary at first to remove hamatosalpinx by laparotomy, in order to undertake later on the formation of a new vag.

ina. On the basis of theoretical considerations, some surgeons have found in my method deficiencies, which however in practice have not come into existence. For instance some adherents of other methods have given expression to the apprehension that the implanted piece of rectum might become gangrenous, that the sphincter might be exposed to a disturbance of function, and that the operation itself might be too difficult. But these deficiencies exist only in theory. My method is often compared to the operations of carcinoma recti and to the difficulties connected with it, but one forgets that these are things not to be confounded. There is a great difference between my method and the others. Whereas in the one case the carcinoma together with the surrounding tissue is extirpated as completely as possible, I try to retain everything. The colon pelvicum, which had been pulled down, is always surrounded by connective tissue. It is not pulled as often occurs with operations of carcinoma, through a wound canal that is deprived of the connective tissue. Therefore the colon is not exposed to any disturbance in the matter of nutrition nor the sphincter to any disturbance of function. Therefore, I repeat, those imperfections which by way of theoretical considerations have been imputed to my method do not

exist practically especially according to the present experiences. There is no reason whatever to fear gangrene of the rectum no less groundless is the fear of greater technical difficulties, which, I suppose, has caused the majority of the surgeons to prefer the small intestine method in spite of the existing apprehensions.

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SOME OF THE RESULTS OF NEGLECTED CHRONIC INTESTINAL STASIS<sup>1</sup>

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THE subject of chronic intestinal stasis has grown enormously in magnitude and importance since its first enunciation by Sir Arbuthnot Lane. Consequently it is impossible to cover the entire field to-night even in the briefest manner. I propose to give an outline of some of the end results in neglected cases, indicating the manner in which the stasis has caused these results.

Chronic intestinal stasis means the habitual undue retention of the contents of the bowel in some or all parts of its length and the consequences—local and general—arising from the retention.

The large intestine is a very usual site of stagnation of faeces, and Vitchnikoff in his splendid writings, attributes all the consequences of alimentary toxæmia to this cause. His view received wide acceptance and undoubtedly there are many cases in which much toxic absorption goes on from the stagnant large intestine. We must remember however that the large intestine is accustomed to deal with mil rubes and that it has a considerable power of rendering them innocuous. The retention of hard stagnant faeces in the large intestine also produces local evils due to the chronic irritation set up by their presence. Colitis is one of them; there are frequent small evacuations containing mucus, and the large bowel (or the latter part of it) gets into a state of tonic constriction so that its lumen, as shown by a bismuth meal, is always narrow, containing only a fine streak of bismuth while the first portions of the big bowel are constantly filled with stagnant faeces. The long-continued irritation is apt to set up a disease still more disastrous, namely cancer. Several parts of the large intestine are especially prone to be affected in this way: the caecum and rectum where large quantities of hard faeces often accumulate and at points where bands form and obstruct the lumen of the bowel, viz. the iliac colon

and the transverse colon just beyond the hepatic flexure. This is only one of the ways in which chronic intestinal stasis leads to the appearance of cancer—by direct irritation.

As already explained the large intestine has considerable power of dealing with microbic infection; the small intestine however is sterile in health and has not this power. When the contents of the lower ileum are dammed back at the ileocecal entrance by the full caecum stagnation occurs in the last coils of the ileum; these coils are then infected by microbes which find their way from the caecum, and the toxins absorbed from them poison the system and give rise to the constitutional changes found in the subjects of chronic intestinal stasis. Dr. J. T. Case has proved the existence of incompetence of the ileocecal valve in the subjects of stasis undoubtedly this facilitates the entry of microbes to the small intestine from the caecum. The first effect of the overloading of the lower ileal coils is to make them drop from their normal position above the pelvic brim into the pelvis. In dropping they pull upon the mesentery. In feeble subjects (especially women) the attachments of the mesentery drop allowing the bowel to fall without effort to prevent it. In more robust persons, however the drag upon the mesentery of the lower ileum, exerted whenever the patient is upright, results in the formation of a thickening of the mesentery at the point (or points) where the pull is greatest. This thickening is the beginning of an ileal kink (Lane's kink). It represents the attempt of nature to prevent the fall of the viscera. Unfortunately the bowel is held up at one point only and in the erect position the caecum and ileum fall on either side of this fixed point, so that an actual obstruction is created aggravating the ileal stasis. It was meant by nature to relieve. Here we have an instance of a "vicious circle" there are many in the history of intestinal stasis. It is clear then, that the ileal kink is not the

original cause of the stasis. It is an effect of the stasis, though when it occurs it aggravates the stasis. Some of the very worst cases of stasis are those in which no ileal kink occurs, the bowel dropping in these feeble subjects without any attempt at resistance by the organism. The terminal coil of the ileum hypertrophies in these cases as in all cases of stasis but if the cecum occupies the pelvis (which is usually the case) the terminal ileum is out of reach, the only positive evidence of stasis in the ileum is, then, that afforded by the X-ray investigation, which proves the prolonged retention of the bismuth in this region.

The effect of the overloading of the lower ileal coils is not confined to these coils; the downward pull affects the whole mesentery of the small intestine and the jejunum is pulled down at its upper end and is thus linked upon the duodenum, which is (normally) fixed at its termination. Behind this duodenojejunal kink the duodenum becomes distended; its width is often double the normal, and the length of its vertical portion five or even six inches instead of three the normal length. The appearance of the static duodenum on X-ray examination is most striking. Its powerful peristaltic contractions are seen to be ineffectual against the kink, in marked contrast to the normal duodenum which expels its contents without difficulty and without delay into the jejunum. The X-rays furnish perfect proof of the dependence of duodenal distention upon ileal stasis. We never find one without the other and we never find a normal duodenum associated with an appreciable amount of ileal stasis.

The distended duodenum is infected with microbes which have ascended from the stagnant lower ileum; thus it is apt to become ulcerated, and chronic duodenal ulcers can always be shown by X-ray investigation to occur in the distended duodenums of stasis. The first part of the duodenum is usually more dilated than any other and it is here that the ulcer is found. The biliary and pancreatic ducts become infected from the duodenum and we get cholecystitis and gallstones in the subjects of intestinal stasis. The pancreas is always hard and nodular in these

subjects; this is found at operations. Eventually carcinoma of the head of the pancreas is apt to appear — another untoward result of neglected stasis.

The duodenal distention has its inevitable effect upon the stomach; pyloric spasm is present to prevent regurgitation from the duodenum; the spasm is apt to become persistent and this leads to overfilling of the stomach, which cannot get rid of its contents in time to make room for the next meal. The greater curvature drops and this is usually aided by the weight of the overloaded transverse colon. A great strain is thus put upon the pylorus, and results in the appearance of a chronic ulcer in some cases. Thus pyloric ulcers, stenosis, and cancers are other results of neglected stasis.

In some cases the liver drops, carrying the pylorus down with it; the strain is then shifted from the pylorus to a point along the lesser curvature of the stomach and a secondary ulcer may then appear at this point. X-ray investigations furnish the most conclusive proof of the relation of these ulcers to pyloric spasm and to chronic intestinal stasis. Ulcers of the lesser curvature lead to hour-glass constrictions; spasmodic in the first place becoming stenotic if the ulcer heals. In a certain proportion of cases cancer supervenes upon a chronic ulcer and I have a number of instances showing the transition from a chronic ulcer of the lesser curvature to a cancer.

The constitutional changes produced by stasis spare no tissue; the nodular breasts of stasis subjects are well known and furnish a ready means of estimating the effect of treatment, the nodules disappearing with the relief of the stasis, but persisting in patients who are not improving and going on, in neglected cases to chronic cystic disease ending in cancer.

The aortic arch becomes atheromatous at an early age in stasis subjects — an important fact to surgeons, since patients do not stand severe operations after the arch has begun to dilate.

Chronic rheumatism of an obstinate kind is apt to occur. It clears up permanently on the successful treatment of the stasis. The thyroid gland shows characteristic changes in

most cases it atrophies so that the rings of the trachea are readily felt through it. Sometimes the thyroid enlarges and the symptoms and signs of exophthalmic goiter show themselves. In other cases again adenomata of the thyroid are found. All these abnormalities clear up permanently on the successful treatment of the stasis.

Glycosuria occurs in some severe cases of stasis and may end in diabetic coma—as in a recent case in which the X-ray investigation revealed evidence of extreme stasis, the duodenum being six inches in the length of its vertical part and howing powerful writhing peristalsis in its attempts to overcome the duodenojejunal kink. There was great ileal stasis, and extreme stasis in the large intestine no bismuth having passed the middle of the transverse colon after 43 hours i. e. at a time when the whole of the bismuth would have

been evacuated in a normal subject. The transverse colon was abnormal in position, descending vertically from the hepatic flexure to the deepest part of the pelvis, making a complete loop in the pelvis, and emerging on its way to the splenic flexure.

Thus glycosuria is due no doubt, to the pancreatic change already described. It is certain that the suprarenals do not escape from participation in the chronic changes of the glands, and the pigmentation of the skin seen in most stasis cases may be due to this cause.

This brief account will serve to indicate the great diversity and severity of the changes brought about by chronic intestinal stasis. It neglected and the need for a widespread understanding of the disease which has only come to be appreciated since the genius of Sir Arbuthnot Lane disclosed its nature to us.

## RECENT EXPERIMENTS DEFINING THE DANGERS OF ANÆSTHESIA

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THE past five years have probably contributed more to precise knowledge of anesthetics, their practical use and the real nature of their dangers than the preceding thirty. For many years there had been almost a condition of stagnation in this field. There were indeed in exigence for example those of the Hyderabad Commission on the dangers of chloroform,—a commission which by the way overlooked the essential point and reached a wrong conclusion. But such investigations were to a great extent merely a rattling of dry bones. There was little that was new in the technique of administration, and less that was suggestive for the opening of new fields of observation and experiment.

The conceptions of the dangers of anesthesia were simple and unquestioned. The expressions "failure of respiration" and "failure of the heart" summed up every thing. Each was a single definite process, although a few particularly broad minded

persons recognized also a "cardomotor failure." In both or in all three of these supposed modes of death the cause of trouble was assumed to be nothing else than an excess of anesthetic or some vaguely guessed at weakness in the patient.

I cannot better express the renewed vitality of investigation in the field of anesthetics than by illustrating it with some of the recent important contributions. I shall take first the work of A. Goodman Levy done in Professor Cushing's laboratory at University College London. As you are aware the Hyderabad Commission reached the conclusion that if the administration of chloroform be pushed it will happen "999,999 times out of a million that respiration will fail before the heart. This amounted to saying that the fatalities under chloroform were mere carelessness on the part of the anesthetists. Naturally the practical anesthetists who had seen patients not only breathing at the

Levy, *ibid.*, 1904, p. 270

Read before the American Gynecological Society, Boston, May, 1904

moment the pulse disappeared but even breathing vigorously for a minute or more thereafter refused to accept such a statement.

The mistake lay in the assumption that fatalities under anæsthesia must be due to excess of the anæsthetic. This is an error which it seems extremely difficult to overcome in the minds of surgeons. They are prone to insist that if that fool anæsthetist had not poured on too much ether (or chloroform, as the case may be) we should not have had all that trouble. Anæsthetists on the contrary are usually quite ready to recognize the fallacy for they know as well as anyone can who has only a very inaccurate method of measuring dosage that trouble often comes when less rather than more has been given.

Levy's work has shown that primary heart failure under chloroform is a perfectly definite and easily induced result of very definite conditions. He quotes cases from the literature showing that one of the essential conditions of such fatalities is *light* chloroform anæsthesia. Such mischances do not occur under deep chloroform anæsthesia for the heart is then merely depressed and as respiration always fails first it is usually easy to effect resuscitation. It is not depression but an abnormally intense irritability of the heart which is the condition underlying this class of fatalities.

Most of the fatalities quoted by Levy occurred either during the initiation or termination of anæsthesia. They involved beside the light anæsthesia another factor namely excitement, strong sensory stimulation or an injection of adrenalin. A man was having the septum of his nose straightened. He was in excellent condition under very light anæsthesia. Some adrenalin was injected, and he promptly died. A girl had passed through an operation in excellent condition and the administration of chloroform had been discontinued. As she had a stiff knee, the surgeon forcibly flexed it. She gave a little cry and died. A man was given an insufficient amount of chloroform so that the stage of excitement was prolonged finally enough was given to induce a moderate depth of anæsthesia. He suddenly became pale and pulseless. In nearly all of these and similar

cases respiration continued and was even abnormally vigorous after the pulse disappeared.

These are types of cases which Levy has shown are easily reproducible on animals particularly cats. I have myself seen many such fatalities unintentionally produced in animals by timid anæsthetists. I have also repeated with entire success Levy's primary experiment in which adrenalin is administered to a cat lightly chloroformed and have obtained exactly the same sudden heart failure and complete and irrecoverable fall of arterial pressure which Levy's experiments show.

What is it that occurs in these cases? Levy has shown by an almost excessive thoroughness of experimental demonstration that it is a condition of fibrillation of the ventricles, — *delirium cordis* — a condition which unlike mere cardiac inhibition or vagus or asphyxial standstill, is in as large an animal as man in the majority of cases practically irrecoverable.

I have tried experiments to see whether similar deaths could be produced in cats by means of adrenalin or sensory stimulation or prolonged excitement under light ether anæsthesia. A certain degree of the cardiac irregularity which is a condition precedent to *delirium cordis* is thus producible but I have never obtained a complete and fatal fibrillation of the heart by this means.

Another of the modes of fatality which is now under analysis is one occurring under ether. Cathcart and Clark find that under light etherization the heart in rabbits is markedly depressed by a degree of asphyxiation which is quite harmless under full anæsthesia. Exactly what this effect consists in and how far it applies to human cases, we must await further investigations to learn. I have mentioned the observation here because, like the work of Levy it bears out a point which was particularly emphasized in the report of the committee on anæsthesia of the American Medical Association a couple of years ago — a committee of which I was chairman — in which the point was especially emphasized that few anæsthetic fatalities are due merely or mainly to excess of anæsthetic.

As a rule they result more or less directly from incomplete anesthesia and the stage of excitement. I may here repeat also another point made in that report, namely that in view of what we now know of the dangers of post-operative chloroform poisoning, and of the not infrequent toxic effect on mother and child when chloroform is used in labor it is about time that the use of chloroform should be given up altogether.

I wish to return now to the subject of partial asphyxia and slight ether anesthesia. Not very long ago I had occasion to observe a difficult subject under ether. For the most part it was administered by what I called an open method — although why the term "open" should be applied to the type of mask employed I am unable to see. For the patient became at times markedly cyanosed. Part of the time a frankly re-breathing method of mask and Rowing bag was used and when too closely applied some degree of cyanosis was observed. From the Rowing bag I obtained samples of air which were afterwards analyzed for ether ( $C_2H_6$ ) and oxygen. The figures obtained are shortly to be published by Dr. John Bryant for whom I made the analyses. I may mention here however that throughout the series of analyses the oxygen content of the air in the bag and the patient's color showed the closest correspondence. Low oxygen in the inspired air occurs with cyanosis and a fair amount of oxygen with a good pink color. It seems to me altogether probable that if analyses had been made of air from the open mask the same correspondence would have been proved. If so this mask was really far from open for when the patient became rigid not only was ether poured on in a steady stream but the mask was also pressed down on the face until marked cyanosis occurred. The Rowing mask and bag seemed to keep the patient a better color in spite of the difficulties of the case as well as to afford a better control of conditions, than did the open drop method with which it was alternated.

From such observations I have become very skeptical regarding the distinction between open and closed methods. The so-called open method is often far from open. There is in the cone a very considerable dead space

from which the patient re-breathes, and at times there appears to be (and this is much worse) a considerable mechanical obstruction to the movements of air. The open method as applied to ether is a very crude and unscientific procedure. In the first place more than half of the ether is volatilized during expiration and blown off into the room. That is one of the reasons why when a refractory patient develops stormy breathing the anesthetist is compelled to pour on such a volume. Boothby has recently demonstrated that the amount of ether in the inspired air necessary to produce and maintain anesthesia is exactly the same in all subjects no matter whether refractory or otherwise. It is true that we recognized that although ether is for the anesthetist a liquid it is for the patient just as distinctly a gas as is nitrous oxide. The time is close at hand in my opinion, when in every well ordered and scientific operating room where ether is used at all instead of its being poured a liquid over the patient's face and into his mouth, there will be a device — and it can be a very simple device — on a stand at the anesthetist's elbow or over in the corner or possibly even down in the bromal, in which the ether will be volatilized and from which it will be conducted to the patient's nose and mouth as if it were merely an unusually strong variety of nitrous oxide. That this idea is rapidly gaining recognition and acceptance is evidenced by the inhalation method of Meltzer the simple and accurate device of my colleague Dr. J. M. Flint and most recently by the anestheticometer of Connell.

It is at once a simpler, safer and more scientific procedure to administer the gas which we call ether vapor than it is to handle liquid ether. In some observations on myself and others in my laboratory we merely put 5 ccm. of ether into a bottle and blew air through the bottle by means of a bellows or rotary air blower into a large bag of a capacity of 20 liters. This gives an air-ether mixture of about 5.7 per cent by volume a little less than the amount needed according to Boothby to maintain surgical anesthesia. In our experiments after obtaining preliminary rec-

ords we administered this air ether mixture to each other by means of a mask and pipe precisely as if it were nitrous oxide. We continued the administration several times to the point of unconsciousness. To all of the subjects of these experiments it was a surprise to find that ether taken in this way provided it is the best quality of ether is not appreciably more unpleasant than nitrous oxide, which is for me rather enjoyable.

The particular object of these experiments was to determine whether there is in reality such a difference in different samples of ether as some practical anesthetists believe. It has long seemed to me that if there is such a difference it must consist very largely in different degrees of intensity in exciting respiration. Some years ago I showed that in dogs one can administer ether so badly as to maintain for twenty or thirty minutes at a time a very excessive respiration and that thereafter they were prone to a failure of the breathing, which without measures of resuscitation frequently proves fatal. Recently Meyer working with Dr J S Haldane has confirmed on man my claims regarding the effects of pain and of ether in exciting hyperpnea. I may perhaps remind you that one of the great advances in physiology during the past few years especially as the result of the experiments of Haldane and of those who have worked under his inspiration has been the proof that ordinarily the breathing is controlled not by oxygen needs but by the  $\text{CO}_2$  output; that there is a large reserve of  $\text{CO}_2$  stored in the body and that if the breathing is abnormally excited and thus its rate considerably reduced there is certain to follow a compensatory period of reaccumulation, during which respiration is subnormal to the point of cyanosis and partial asphyxia or in which the breathing even fails altogether. Thus, in my experiments comparing different

samples of ether the points noted were both the degree of hyperpnea during a brief period of administration and also the intensity and duration of the period of subnormal breathing which followed.

Briefly stated it was found that with a grade of ether such as we buy for ordinary laboratory use in tanks of several gallons there was a marked augmentation of breathing in one subject and a fairly active hyperpnea in another. With the best grade of ether such as comes in small sealed cans the excitant effects were comparatively slight, while the same ether after being kept for two months with the addition of a few cubic centimeters of water a ready access of air through a loose cork, and standing in a place exposed to the sunlight, gave very marked hyperpnea in a sensitive subject and a considerable augmentation of breathing in insensitive subjects. Particular attention should be called to the fact that whenever hyperpnea was induced it was followed by exactly such a period of subnormal breathing Cheyne-Stokes respiration and apnea interrupted by deep gasps as is the well recognized result of apnea i. e. diminished  $\text{CO}_2$  consequent on excessive respiration.

Such a condition of insufficient breathing is an extremely common consequence of etherization. It adds the evil influences of a more or less prolonged period of insufficient oxygen supply to the other conditions lowering the patient's vitality. It is clear that the logical procedure to prevent this is some such method of administering ether vapor as Dr Gatch showed to be so advantageous with nitrous oxide and also some method of administering a sufficient amount of  $\text{CO}_2$  in the air breathed after the anesthesia is ended to stimulate respiration to a more rapid elimination of the ether with which the body is saturated and to prevent apnea or subnormal breathing, anoxemia, and cyanosis.

## OBSERVATIONS ON THE GONOCOCCUS COMPLEMENT-FIXATION TEST EMPLOYING SPECIFIC AND NON-SPECIFIC ANTIGENS

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**S**UPPLEMENTARY to work undertaken about a year since and announced for subsequent publication in an article<sup>1</sup> read before the Philadelphia County Medical Society May 28, 1913, we desire at present to summarize briefly the results obtained in an analysis of several hundred sera subjected to the complement fixation test employing specific gonococcal and non-specific antigens.

In the performance of the complement fixation reactions for suspected gonococcal and syphilitic infection there is little or no fundamental variance in the technique other than in the employment of different antigens. Whether it be the Wassermann or the gonococcus complement fixation test, one essential stands paramount, namely the absolute standardization of all substances entering into the reaction and this applies more particularly to the gonococcal antigen, because of its greater instability owing to watery extraction, than to the alcoholic syphilitic extract.

An important feature of the complement fixation reaction in gonococcal infections is the necessity of employing a polyvalent antigen owing to the apparent diversity in the various strains of the gonococcus. Thus we have utilized in our studies monovalent and nonvalent antigens prepared by washing off in sterile distilled water forty-eight hour-old cultures of gonococci grown on blood agar; these suspensions were shaken for one hour, autolyzed for twenty-four hours in a thermostat at temperature of 37° C. and heated in a water bath at 60° C. for one-half hour. Before use, these antigens are diluted 1:10 by the addition of 0.85 per cent salt solution.

Although a negative reaction may be erroneously contradictory a positive result

is most reliable. In fact, more specific than the Wassermann, since thus far we have discovered no alien infection capable of producing a positive result, nor have we found any drug (as mercury in the treatment of syphilis) influential in negating a positive reaction. These facts naturally and early suggested the advisability of comparative studies, using non-specific with the specific antigens in the performance of these serological reactions. Accordingly polyvalent antigens were prepared from various non-gonorrheal gram-negative and positive bacteria, namely the micrococcus catarrhalis, the diplococcus meningitidis, the streptococcus pyogenes, the pneumococcus lanceolatus, the micrococcus albus and aureus, the coccus bacillus, and the corynebacterium pseudodiphtheriae.

The technique which we have employed with the greatest satisfaction is essentially that used in the performance of the Wassermann reaction, substituting merely a specific gonococcal or non-specific antigen for the syphilitic hypotonic antigen, always using the accurately standardized single complement unit, the required inactivations and the routine standardization of antigen, hemolytic amboceptor and suspension of sheep red blood-corpuscles. A detailed description of the fundamental serological principles involved in complement fixation or deviation will be omitted. A study of the accompanying table will, it is believed, serve to give a comprehensive understanding of the technique and actual steps of the routine performance of the reactions.

Reviewing the results of our work to date with especial reference to a study of specific versus non-specific antigens to be reported in detail in a later communication, we have deduced the following facts:

1. Very rarely have polyvalent antigens prepared from meningococci, pneumococci,

<sup>1</sup>The Gonococcus complement fixation test and Analysis of Results from its Use

TABLE OF TEST REACTIONS

	No. Test Tubes	Antigen (Dilution 1:10)	NaCl Solution (to 10%)	Protein (Diluted)	Known Positive (Inactivated)	Known Negative (Inactivated)	Complement (Dilution 1:10)	Hemolysin (Antiserum) (Dilution 1:10)	Red Blood Cells (Dilution 1:10)	Results (immediately or increase after refrigeration)	Objects of the Reaction
Tests for Antigen Standardization and Controls	1	cc		cc	cc	cc	cc	cc	cc	Incomplete hemolysis	T determines quantity of antigen to be used in test proper
	2									Partial hemolysis	
	3									No hemolysis	
	4									No hemolysis	
	5		1							Complete hemolysis	T proves that the antigen does not in itself react complementary
	6									Complete hemolysis	T proves that twice the antigen does not in itself react complementary
Tests for Complement Standardization and Controls	7		1							Incomplete hemolysis	T proves that three times the antigen does not in itself completely react complementary
	8									Incomplete hemolysis	T determines quantity of complement to be used in test proper
	9									Incomplete hemolysis	
	10									Complete hemolysis	
	11									Complete hemolysis	T determines quantity of complement truly the degree of complement fixation
Tests and Controls for the Inactivated Serum	12		1							M hemolysis (Positive reaction) (ant)	
	13									N hemolysis (Positive reaction) (ant)	Shows that, here, as no immune body present in the patient serum, at the end of the reaction to fix the complement
	14									Complete hemolysis (Negative reaction)	
	15		1							Complete hemolysis	Proves that the immune body itself will not fix complement

Incubation at 37° in water bath for one half hour

Incubation at 37° C in water bath for three-quarters of an hour

streptococci, staphylococci, colon bacilli or corynebacteria sufficed to fix complement. This does not jeopardize the specificity of the gonococcus antigen since it is explained on the basis of superinfection of a mixed infection.

2. In ten per cent of sera examined a weakly positive result was obtained with polyvalent micrococcus catarrhalis antigen in these cases the reaction was much more marked with the various gonococcal antigens. Thus it may be inferred that the association between the gonococcus and the micrococcus catarrhalis is not positively and absolutely defined and it is not unlikely on the one hand that a culture of the *M. catarrhalis* is occasionally included in a supposedly

specific polyvalent gonococcus antigen while on the other it is undoubtedly true that a mixed infection often due to the *M. catarrhalis*, exists in patients suffering from gonorrhea and its complications.

3. A negative gonococcus fixation test does not necessarily mean that the patient is not infected with the gonococcus. In a primary uncomplicated acute case we have never observed a positive reaction prior to the sixth week, nor have we obtained positive reactions where the anterior urethra or agnathia alone were involved.

4. A positive result apparently is more specific than the Wassermann reaction since thus far we have found no diseases other than



the peritoneum. The vesico-uterine fold of peritoneum is now readily grasped with tissue forceps and incised.

*D Delivery of the body of the uterus.* In delivering the uterus the fundus should be brought out first, as the diameters of the fundus are much less than of the anterior wall of the uterus. If the uterus is very large or the case is complicated by fibroids or disease of the adnexa, median longitudinal section through the anterior wall of the cervix and lower uterine segment will facilitate incision of the peritoneum and delivery of the body of the uterus.

*E Excision of parts of the vaginal flaps.* The hypertrophied mucous membrane that is frequently found near the urethra should be sufficiently excised to prevent subsequent protrusion. Enough of the vaginal flaps should be excised to dispose of redundant tissue, but enough must be left to allow approximation without tension. The anterior lip of the cervix is now amputated.

*F The suture.* The first suture should be so placed that the hernial opening of the bladder will be obliterated by the transposed uterus. If an urethrocele is present the suture should be passed through the vaginal flaps so that when tied it will draw and hold the urethra in its normal location. Before tying the first suture the uterus is repositioned sufficiently to avoid strangulation. Careful observation will show the presence of considerable submucous connective tissue which if included in the suture adds another layer to the already firm wound surface. Inclusion of the uterine or cervical tissue in each vaginal stitch as suggested by Wertheim materially lessens the danger of a recurrent prolapse.

The transverse vaginal incision should usually be closed longitudinally to lengthen the anterior vaginal wall. A complete circular incision about the cervix as advocated in my original paper will permit insertion of the suture so as to further displace the cervix upward and backward, and is useful when the vagina has become much shortened.

Complete hemostasis is essential. Low grade infection by vaginal bacteria follows any considerable retention of wound secretion

*G Perineorrhaphy.* The ultimate success of the entire operation depends largely upon how efficiently the perineum is repaired. The perineal repair should extend to the upper border of the levator ani and should include as much of the pubic portion of this muscle as is possible without too much tension upon the sutures or excessively narrowing the vagina.

#### MODIFIED TECHNIQUE

*I Excision of part of the body of the uterus.* This should be done whenever the uterus is very large. The excised portion should consist mostly of the anterior uterine wall. Certain cases should include some of the fundus. Enough of the posterior uterine wall should be left to close the hernial opening through which the bladder protrudes. The length of the remaining portion of the uterus should be sufficient to prevent traction upon the cervix and shortening of the vaginal canal when the wound is closed.

*II Amputation of the cervix.* This should be done when the cervix is much hypertrophied and especially when very long and protruding through the vaginal orifice.

*III Excision of entire uterine mucosa.* In cases where much of the uterine body or cervix is excised the operative technique is simplified by excision of the entire uterine mucosa. Most of the cervical tissue can easily be excised and then the closure of the wound will materially shorten the broad ligaments. After the mucosa is excised the uterine and vaginal wounds are very satisfactorily closed by one tier of figure-of-eight sutures.

#### AFTER-CARE

Many of the cases require the use of a catheter for two or three days, and occasionally as long as they are confined to bed. Early getting up in these cases is advisable. Elevation of temperature sometimes results. In these cases the head of the bed is elevated and moist dressings are kept over the vulva. The fever disappears soon after the escape of some decomposed serosanguinous discharge.

A considerable number of cases have some vesical irritation for two or three weeks. In only one instance has this bladder disturbance continued. The complication may be the



# DEPARTMENT OF TECHNIQUE

## THE RÖNTGEN DIAGNOSIS OF DUODENAL ULCER<sup>1</sup>

A COMPARISON OF THE DIRECT AND INDIRECT METHODS

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A RECENT paper by Dr. R. D. Carman on "The Radiologic Signs of Duodenal Ulcer" has seemed to the writers an insufficient expression of the present status of the roentgen diagnosis of duodenal ulcer.

Carman reports 198 cases of duodenal ulcer, operated on at the Mayo Clinic, all of whom had a preliminary roentgen examination. Out of this large number he was able to make a definite diagnosis of duodenal ulcer in only 135 cases. In other words, the failures of positive diagnosis amounted to approximately 32 per cent. The published work of Cole and of the writers does not show such a large percentage of diagnostic failures when the modern direct method of duodenal diagnosis has been used.

In order to explain better our position in this matter we shall briefly outline the development of the present two schools of roentgen barium study especially as related to the diagnosis of duodenal ulcer. The pioneers in this work, who were largely Germans and Austrians, were forced by the necessities of their clinics to depend upon the fluoroscope almost entirely. As a result, the early fundamental work was based upon signs and findings that could be brought out largely by fluoroscopic study. In consequence the basis of diagnosis gradually developed into what might be called symptoms complex—that is, a number of fluoroscopic signs largely of a functional nature were grouped together and upon them diagnoses were founded. Among these signs were exaggerated or lessened peristalsis, antiperistalsis, increased or diminished emptying time of the stomach, spasm, six hour gastric residue, pressure-tender points, etc. as well as the clinical history. This method of study is the *indirect* method of barium diagnosis.

As a result of this study much valuable data was obtained, and great progress was made in the diagnosis of surgical conditions of the gastrointestinal tract. It has been found however

that this method of study, especially when applied to the pyloroduodenal region, is frequently inadequate. Many cases may be classed as negative, which might yield positive pathological data if a more careful method of investigation were used. That is to say errors of diagnosis were not so much errors of commission as errors of omission. In consequence many investigators, especially Americans, have felt that a more careful study of the above mentioned region was necessary to detect these overlooked cases.

The meal which had been used by the Continental observers, and which is still used by most of them, was the standard Rieder meal. This consists of 40 gm. of barium subcarbonate in about 300 ccm. of cooled cereal. Later this was modified to contain an equivalent amount of barium sulphate. Thousands of observations have been recorded at different clinics with this meal, and naturally much valuable data was accumulated. This meal, however, was too coarse and stiff to satisfactorily fill out the duodenum long enough to allow it to be observed directly. Gradually the experience of many roentgenologists led them to the use of artificially prepared buttermilk. This was desirable not only because it very easily filled out folds and crevices in the parts to be examined, but it was easily obtainable, quickly prepared, and quite palatable. Incidentally it was found that the barium meal was kept in a liquid form, with buttermilk, for a much longer time throughout the intestinal tract than by previous meals. As a consequence, the constant demonstration of the appendix, among other conditions in the right lower quadrant, was made possible.

It was found necessary with the improved meal to use two to three times the amount of barium contained in the Rieder meal. The writers, for instance, have used 90 to 100 gm. of barium subcarbonate in a mixture of 500 ccm. of artificially prepared buttermilk and water. As a result of the marked variation of barium it is impossible

<sup>1</sup> Ann. M. Assn. 1921, vol. 10, p. 10.

Read in part at the opening meeting of the Roentgen Society of New England, Boston, May 4, 1921.

to use the same functional data for diagnosis. That is to say conclusions drawn as to rapidity of emptying, six hour gastric stasis, position of the head of bismuth in the colon at six hours, etc. must be entirely disregarded.

This is a point which has not been properly appreciated by many roentgenologists. They have used various kinds of meals,—not only butter milk but malted milk, plum milk, water mashed potato, etc.—and have varied the amount of bismuth or barium, and yet have attempted to apply to their work the conclusions based upon the observation of functional disturbances in thousands of cases done under the Rieder technique. Obviously this is incorrect. The only proper course left for one who wishes to use these functional data is to accumulate a large number of cases, done with more satisfactory mixtures, and check them up with operative results. This has been done it is true by Carman with his tremendous clinical material. He undoubtedly has a right to draw certain conclusions as to motility of the stomach and intestines with his technique. However as we have stated above his results with duodenal ulcer (32 per cent errors) do not warrant placing any reliance upon this indirect or inferential method as a dependable basis for the positive diagnosis of this condition.

The opposite school which has developed may be called the school of *direct* diagnosis. It is the morphological school. Its object is not to study the secondary or indirect manifestations of an organic lesion but to demonstrate if possible, the actual anatomical lesion itself. We have found by experiment that buttermilk mixtures are best suited for such study.

This method of diagnosis, when applied to the problem of duodenal ulcer has yielded results of a positive nature that has not been reached by indirect methods in the hands of any investigators. Indeed, the European observers have been frank to admit that the positive diagnosis of duodenal ulcer by means of the roentgen ray is still an impossibility. Holdreicht and Haudek, in their last published work, confess that they are satisfied in the doubtful cases with diagnosis of peripyloric ulcer without attempting differentiation between post-pyloric and pre-pyloric ulcers.

The published results of work done by Cole and by the writers have certainly given sufficient basis for our contention that the direct method of study of duodenal ulcer will yield a far greater percentage of correct diagnoses than the indirect

We shall now consider in somewhat more detail, the data upon which the indirect method of diagnosis has been based. We shall follow the signs as outlined by Carman, partly because his report contains the largest number of operative cases with roentgen control that has ever been published, and partly because his study of the indirect data is as careful a presentation of this method of diagnosis as has appeared. He divides the roentgen signs into "major and minor groups." His major signs consist of increased gastric peristalsis, six-hour bismuth residue and demonstrable diverticulum of the duodenum.

*Gastric hyperperistalsis* is a sign that has been emphasized more than any other as a dependable basis for the roentgen diagnosis of duodenal ulcer. As we have already stated in an earlier paper, abnormally marked peristalsis is an important sign if it is found. The difficulty is that even with Carman a large series of cases it is present in only 57 per cent of his proved cases of duodenal ulcer. It can undoubtedly be produced by other conditions than duodenal ulcer. Among these are pyloric stenosis due to other causes, such as early carcinoma, and also abnormal nervous influences. We have certainly seen most violent hyperperistalsis at times in individuals with no organic disease present. We believe this is a very treacherous sign upon which to found diagnosis of duodenal ulcer. Its presence is merely suggestive and its absence certainly does not warrant a negative diagnosis.

*Six-hour bismuth residue* in the stomach depends to a large degree, as we have already stated, upon the character of the bismuth meal used. Undoubtedly the large number of roentgen examinations made by Carman has enabled him to attach a definite significance to the presence of six hour stasis with in particular meals and technique. However he found this residue in only 36.3 per cent of his cases of duodenal ulcer. This corresponds fairly closely with the observations of many other investigators. Indeed, Holdreicht and Haudek<sup>2</sup> found this residue in only 10 per cent of their duodenal ulcers. Thus we see that, at the very best, about two-thirds of the cases will give us no positive information as regards this particular diagnostic point.

The *diverticulum* of the duodenum, so called, is undoubtedly important if it is present. Carman found it in only two cases out of 98. The writers have seen this condition in about 25 cases. Its rarity does not enable it to be depended upon as a constant factor in diagnosis. Loc

<sup>2</sup>Holdreicht and Haudek, *Portschke's u. d. Ochsens d. Roentgenstrahlen*, 1913, 221 figs.

George and Garber, *Ann. Quart. Roentgenol.*, 1913, 17, 346. Loc. cit. 694.

dently we do not believe that this diverticulum is due at all to penetrating ulcer, in the sense that

Haudek's niche is produced by penetrating gastric ulcer. Such a penetration is extremely rare with duodenal ulcer. In our experience these diverticula have been caused by the pull of adhesions for a considerable length of time which finally resulted in the production of small sacculations. Sometimes also such sacculations may be the result of a cicatrizing process which involves all the duodenal cap except one small section in which the bismuth remains (Fig. 11).

We must therefore conclude, in regard to these so-called major signs, that the one which is considered most valuable, gastric hyperperistalsis, leaves us without any help in at least 43 per cent of cases. The combination of hyperperistalsis and six-hour residue, although found in only 24.7 per cent of his cases, is, according to Carman, "worth more than 95 per cent in the diagnosis of duodenal ulcer." This statement on the face of it seems hardly compatible with his statistics.

Again he states that the combination of hyperperistalsis and six-hour residue or a diverticulum when found in an otherwise normal stomach, constitutes about the only evidence on which a purely radiologic diagnosis of duodenal ulcer may safely be advanced. If this be true then in at least 75 per cent of cases a purely roentgen diagnosis is impossible. The results of the direct method certainly do not support this statement.

As a matter of fact, we do not feel that these alleged major signs are of any value as dependable aids for positive diagnosis in every instance. This is the conclusion that must be drawn from Carman's own published statistics.

When we come to the study of what he calls the minor signs in roentgen diagnosis, we certainly agree with him as to their relatively inferior value in all but one instance which we shall consider at the end.

*Hypermotility of the stomach* is a sign which we agree is by no means pathognomonic of ulcer since it occurs in achylia gastrica, carcinoma, and various motor neuroses. In duodenal ulcer as we have explained in previous publication the presence of hypermotility results from balance which exists between the physiological tendency towards rapid emptying of the stomach from duodenal irritation on the one hand and the mechanical obstruction from the cicatrized portion of the duodenum on the other hand. The results are so confusing that they offer no basis for definite conclusions to be applied to any particular case.

*Hyperionus of the stomach* the presence of *pressure-tender points* and the *lagging of bismuth* in the duodenum are undoubtedly all minor signs in the roentgen diagnosis of duodenal ulcer. No one of them gives any pathognomonic evidence, and any strict reliance upon these signs is certain to lead to errors of diagnosis.

When however we consider the last minor sign, namely *deformity of the outline of the duodenal cap* we feel that we must emphatically protest against including this among minor signs. There has been already too many loose statements about irregularity and deformity of the duodenum, and their value in the diagnosis of duodenal ulcer. The word "irregularity" does not convey sufficiently the idea as to just what we are attempting to demonstrate by the direct study of these cases. What we try to show in every instance is either a normal duodenum or the exact size, extent, and character of the actual duodenal ulcer. The entire problem revolves about the method of study of the duodenum.

In the application of the roentgen ray to surgery generally the development has always been along the line of attempting to get real positive data and eliminating all bases for diagnosis that were uncertain and indefinite. This trend is seen all ready in the roentgen study of fractures, of bone diseases, and of renal calculi. The same point of view is equally true when applied to duodenal ulcer. The only basis for definite opinion should be the actual demonstration of a normal or an abnormal duodenum. The direct school of roentgen diagnosis disregards all the indirect, so-called, major and minor signs, and restricts itself to one problem namely the attempt to demonstrate adequately the anatomical condition of the duodenum and the determination as to whether the duodenum so demonstrated is normal or pathological. This problem is largely one of careful and exact technique.

The fluoroscopic method, when applied to the study of duodenal ulcer from this strict point of view is entirely unsatisfactory. It is true that sometimes the duodenum can be seen in its entirety but it can never be seen for a long enough period of time to satisfy one as to its anatomical completeness and it certainly cannot be shown in all cases. In the standing position, in which the fluoroscope is ordinarily used this demonstration is usually impossible. All that can be shown is the jet of bismuth into the cap which is speedily emptied.

It is only with the plate method carefully carried out, that the duodenum can be demonstrated in its entirety. We do not for a moment

mean to infer that the fluoroscopic study of the gastro-intestinal tract is worthless. The fluoroscope undoubtedly has its valuable applications in the study of the stomach and many other parts of the alimentary tract. However when it comes to a study of the duodenum and the problems involved in duodenal ulcer the fluoroscope must really be considered as of little value.

Serial roentgenography is really the ideal way of studying these cases, but it is not necessary always to take an extremely large number of plates. Only enough plates need be taken to convince the investigator of either the normal condition of the duodenum or its constant abnormal condition. No set rules can be given as to the position of the patient during examination. All the positions—prone, standing and lateral—may have to be used in order to obtain the desired information. The exact procedure to be followed must be worked out in each individual case as it goes along. This requires the use of rapid developers and the development of plates constantly during the course of the examination. Of course this is a more troublesome process than the indirect method, but the more accurate results obtained are certainly worth the slight extra trouble and expense.

The writers were the first to emphasize the value of the lateral view in the study of the duodenum. We believe that this is the most important single method known that will adequately demonstrate the duodenum every time. The technique is very simple. The patient lies on the right side upon a small plate with an intensifying screen. The rays enter the left side of the patient. It is advisable to use the smallest cone and diaphragm obtainable and the cone must be placed almost in contact with the left side. The length of time of the exposure depends upon the size of the patient. In general it should be about twice as long as is necessary to obtain a satisfactory plate of the same patient in the prone position.

With this technique not only the first portion of the duodenum, but the descending duodenum, and in many instances the transverse portion are readily brought into view (Fig. 2). In well-nourished persons this position is the only one that will bring out the first portion of the duodenum satisfactorily. These people usually have the lesser horn of stomach, with the pylorus and duodenum held over to the right, behind the antrum. These regions are not brought well into view when plates are taken or fluoroscopic examination is made, in either the prone or standing positions.

Likewise, the lateral position is of value in

those cases where there is pylorospasm. Here the force of gravity is added to the peristaltic force of the stomach and the weight of the meal will relax the pylorus and enable the duodenum to be well filled out. This sometimes may require an hour or more to wait and in rare instances may even require a repeated examination on another day, but at some time the pylorus will relax and the duodenum will fill out. This renders possible an opinion as to whether a spasm is the result of duodenal ulcer or not.

We will briefly outline our position as regards the direct demonstration of duodenal ulcer. Is the first place 95 per cent of all duodenal ulcers, as is well known, occur in the first portion of the duodenum. Therefore careful anatomical study of this part, as outlined with bismuth, affords us the opportunity of studying the great majority of ulcers. The smaller groups, which is found in the descending and transverse portions of the duodenum, likewise give roentgen signs which are quite definite.

The first portion of the duodenum, as we have frequently maintained, has a very constant anatomical structure. It always has a regular contour and smooth mucous membrane unless there is actual disease present. This anatomical constancy is seen in the definite bismuth picture which is obtained of the duodenal cap. The cap shows a smooth outline more or less triangular or elliptical in shape (Fig. 3). There is no trace of the serrations due to valvular constrictions, such as are found in the descending and transverse duodenum. This normal cap can be found and demonstrated in every normal individual. There is absolutely no exception to this statement. We have shown a characteristic cap even in a two-day-old infant.

Many roentgenologists have believed that the characteristic normal duodenal cap could not be demonstrated every time in normal persons. This failure is due in every instance to either improper beamwidth, mixtures, improper technique, or both. The Rieder meal, we know, will frequently fail to show this cap. Bismuth will always fill it out, if normal, at some time during the examination. In many cases, especially in the steer-horn stomachs, as above mentioned, the duodenum will not come into view in either the prone or standing positions. In such cases the lateral view is especially helpful. If bismuth is used and the lateral position is applied, the cap can be demonstrated in every instance if the duodenum is normal and if enough plates are taken. We must repeat, there is no exception to this statement.



Fig. Normal duodenum in three areas. Proved by operation for other purposes. (Operation by Dr. Godfrey R. der.) A first portion of duodenum B descending duodenum C transverse duodenum. Not the anying character of the three portions.

As a result any defect or deviation from this outline, if found constantly on a number of plates, can be regarded as a pathological condition. Sometimes the characteristic deformity of the duodenum is so striking as to be unmistakable. At other times the distortion may be deceptive. The only feature that must be insisted upon is the constancy of the deviation from the normal contour. One plate showing a definitely normal cap rules out the possibility of indurated ulcer here, even though all the other plates show apparent abnormalities.

Spasm is one of the big sources of error. With spasm, however, we do not obtain the characteristic ulcer deformity. Instead there is usually an incomplete filling of the cap, varying from one plate to another. At some time during the examination, especially with one of the lateral views, a normal cap will be obtained.

Pressure from other organs, or from abnormal ly placed blood-vessels, will sometimes distort the cap, but it will always be smoothed out some one of the positions.

When gall bladder adhesions are present, the cap will usually be completely filled out, but fixed to the subhepatic region. The fixation of the duodenum and antrum is especially demonstrable by manipulation under the fluoroscope. Sometimes the cap will show the definite serrations due



Fig. Lateral view of normal duodenum in man, weighing over 200 pounds. The three portions of the duodenum are seen almost as clearly as in Fig.

to the pull of these adhesions. Again the enlarged gall bladder, especially when filled with stones, may leave a concave impression on the duodenum. In some cases evidence of gall bladder adhesions will be present together with the deformity of the duodenal ulcer. These cases are often confusing. Small adhesions from the gall bladder or liver may be overlooked, but the ulcer deformity is practically always recognizable.

The duodenal ulcers themselves usually show a characteristic bismuth deformity of the cap on one side with an indenting on the other side very similar to the incision seen with gastric ulcers (Fig. 5). Dr. William Mayo has carefully studied the pathology of a number of excised duodenal ulcers. He found that in these cases the

characteristic and striking process present was a very abundant connective tissue formation in the deep layers. This cicatrix is always out of proportion to the minute mucosal defect which is usually present. It is just this disproportionately big cicatrix that we demonstrate by its effect in deforming the contour of the bismuth mass. Recently in an increasingly large proportion of these cases we are beginning to show not only the effect of these cicatrices, but the actual mucosal defect itself, small as it is. When careful plates are taken, especially in the lateral position, the stream of bismuth can be fre-





Fig. 5. A characteristic ulcer of superior border of duodenum. (Operation by Dr. John Bottomly.)



Fig. 6. A large ulcer of first portion of duodenum. (Operation by Dr. John Bottomly.)

duodenal ulcer with which clinicians are concerned and it certainly is not the type with which surgeons can have anything to do. We therefore feel confident in stating that the demonstration upon plates of normal duodenum definitely rules out the possibility of indurated or surgical duodenal ulcer.

We have now had up to date 62 operated cases of duodenal ulcer all of which were previously examined by our method. This covers a period of time extending from September 1912 to April 5, 1914. These operations were performed by a number of surgeons in this country. Out of this number a correct diagnosis of duodenal



Fig. 7. A first portion of duodenum on August 20, 1914. Arrows point beneath ring, showing defect. (Operation by Dr. J. F. Jones.)



Fig. 8. A ulcer of duodenum. B an non-ulcer. Plate taken with patient prone. If perpendicular as present here.



Fig. 1. Same case as above. Shows the duodenum. Duodenal ulcer is outlined. It demonstrates the use of perforated barium. A portion of fundus of stomach is outlined.

le with the localization of the ulcer in the duodenum. In all the cases diagnosis of duodenal ulcer is made but there is a fair percentage of minor details as follows:

(1) In the Kuntze diagnosis of duodenal ulcer in inferior border of duodenum not penetrating into upper border. At operation the ulcer is present but the second defect is found to be a defect in the pylorus.

(2) Roentgen diagnosis of duodenal ulcer. At operation thickening was found in the fundus but no ulcer was seen at operation.

(3) Kuntze diagnosis of duodenal ulcer. The ulcer was found in the pylorus, with a cicatrix extending both into the fundus and the antrum pylorus.

In one case only of the series there was doubt as to the diagnosis. In this case the diagnosis of duodenal ulcer is made in spite of the fact that one of the three films showed normal duodenum. The incomplete filling seen in the other plate was the result of spasm probably after the removal of the appendix. This was found at operation. In this case the error in diagnosis was due not to the failure of the method itself but to carelessness at operation. The case is given to show that normal duodenum is thus sufficient to throw my diagnosis of duodenal ulcer.

A regrettable negative aspect of the method which we have had approximately 150 other operated cases in which we had previously reported a negative duodenum. When these cases came to operation for other conditions, in not one of them was duodenal ulcer found. In one autopsy duodenal ulcer was found where the roentgen examination was negative.

It is thus obvious that with the direct method it is possible to achieve results in the diagnosis of duodenal ulcer compared with which the indirect method, with its large percentage of errors in the past has not certainly offers no encouragement. It is also certainly true that the demonstration of the etiology of ulcer from being a minor

in reality the one not only dependable but the diagnosis of indurated duodenal ulcer.

#### SUMMARY

In the roentgen diagnosis of duodenal ulcer the method of study has gradually developed. These are the direct and the indirect methods of diagnosis. The indirect method, generally used by European observers is based upon a consideration of symptoms complex. These are groups of signs usually of a functional nature which have been found associated with organic lesions.

The direct method disregards this evidence



Fig. 2. Same patient as lateral view. A duodenal ulcer is clearly due to cicatrix of ulcer seen much more clearly than in previous position (Fig. 1). (Operated on 1 Dec. 1911.)

entirely and merely determines the normal or pathological condition of the duodenum. This can be done only with careful attention to technique. From this strict point of view fluoroscopy is very unsatisfactory. Repeated plates are much more valuable. They must be taken in the prone standing, and especially the lateral positions, and from these plates the anatomical condition of the duodenum is determined.

A normal duodenum can always be shown if proper technique and proper barium mixtures are used. The demonstration of a normal duodenum even on a single plate, rules out the presence of indurated or surgical ulcer.

Duodenal ulcers show a characteristic deformity due to connective tissue, with stenosis. A stream of barium seen entering the mucosal defect.

Of 82 operated cases of duodenal ulcer an exact diagnosis was made in 78 cases. In 3 cases duodenal ulcer was reported, but there were minor errors of diagnosis. In one case there was complete failure of diagnosis.

Of 150 operated cases in which a gastric roentgen diagnosis was made of duodenal ulcer was not found in any case.

In one unoperated case a duodenal ulcer was found, where the previous report had been negative.

The results of the direct method are far superior



Fig. 1. A, accumulation due to almost complete obstruction of the first portion of the duodenum by cancer. B, descending duodenum. (Operation by Dr. A. B. Foose.)

to those of the indirect method, even in the best of hands.

The actual demonstration of the lesion itself is the only important factor in the diagnosis of indurated duodenal ulcer.

## THE OPEN METHOD IN THE REDUCTION OF FRACTURES

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A DISCUSSION of the treatment of fractures, particularly the advancement in such treatment is of interest to the general practitioner as well as to the surgeon, but probably no part of general practice is so much overlooked as that accepted with a great hesitation. There has been great deal written of late on fracture treatment. Many of these articles stand out as brilliant monographs, notably those of Lane while there are capitulations. It is, of course, impossible for me to discuss and illustrate more than certain lines of development in the treatment of fractures which I feel are of importance. We all have had our own principles in fracture treatment so thoroughly drilled into us in our school and hospital training that it is hard to accept new ideas, but with the progress of aseptic and operative technique much is being accomplished in surgery that has heretofore seemed hopeless. Within five years, surgeons have been considered radical who have intervened surgically in the treatment of simple fractures. I know on the other hand that many surgeons with little judgment and surgical skill have attempted the operative treatment of fractures, and, aside from frequently obtaining sepsis in the wound have often added foreign material to suppurate later.

The method of reduction by manipulation, closed reduction, is not without danger to vessels, nerves, and muscle besides often not attaining the desired end and the return to proper alignment. As an illustration of this, take the usual fracture of the femoral shaft in which end-to-end position is rarely attained. There are out of a large proportion of fracture cases that one sees a certain percentage that have given unsatisfactory result by following this conservative method. It is concerning these types of fractures that I shall speak.

This small group, I believe, as a routine be subjected to open incision and an anatomical reduction of the fragment. Aside from the return to proper alignment there also should be considered the question of joint strain. It is strikingly seen in orthopaedic surgery more than in general surgery. The general surgeon treats his fracture of the femur and get union and often never sees the patient again. Years after an orthopedist finds the patient with scoliosis

resulting from short leg. A shortening of one half to three-quarters inch in a growing child causes joint strain resulting in the development of structural deformities. Nevertheless the surgeon considers one half inch shortening a good result. Personally I have reached the stage where I subject all fractures of the femur except in the infant, to reduction by the open method. There has always been the dread of introducing sepsis in the open fracture wound. I can combat this point only by calling attention to the parallel reluctance of the surgeon to open the knee joint. It has been only within the last ten to fifteen years that fractures of the patella have been subjected to operative interference as a routine yet it has been well recognized that in order to get a true bony union in patella fractures not stellate in character operative interference must be undertaken.

Up to the time Mr. Lane began vigorously to champion the open treatment and the use of plates strong prejudice against the open treatment of fractures existed. This as justified partly by result and partly by tradition. Strict aseptic and non-traumatic technique became recognized as all important. A surgeon thus afflicted founded has the moral right to treat any fracture by the open method and does not thereby add to the existing dangers. The advent of the open method may however bring many disastrous results unless proper asepsis has been carried out. With asepsis we can open safely a fracture and skillfully reduce it with less damage to the surrounding part than by manipulation.

Undoubtedly this is the greatest advance that has been made since the advent of bone plating. I feel strongly that too many metallic implants are being used. Osteomyelitis and irritation from loose screws and metallic material in contact with bone may sooner or later occur. Just as seen occasionally in old cases of excision of the knee in which silver wire has been used, discharging sinuses may open ten to fifteen years after the insertion of the wire. Rarely therefore I believe a necessary plate—only in exceptional cases where position cannot be held following reduction by manipulation or open method even when held with some absorbable material. In other words, plating is the method of last resort.

Radiograms as routine should be taken before



Fig. 4 (a) Fracture in fifth metacarpal with fracture dislocation of proximal end of phalanx.



Fig. 4 (b) Fracture in fifth metacarpal with fracture dislocation of proximal end of a phalanx. Complete reduction by incision following the previous features of closed method.



Fig. 5

Fig. 5

Fig. 5

Fig. 6

Fig. 5 (a) Fracture in lower one-third of humerus. Before operation.

Fig. 5 (b) Fracture in lower one-third of humerus. After reduction by open method.

Fig. 6 (a) Fracture in lower one-third of humerus. After reduction by open method. (Plaster dressing)



Fig. 7.

Fig. 8.

Fig. 7. (a) Incision of supracondylar fracture of humerus before operation. (b) Incision of supracondylar fracture of humerus after operation.

Fig. 8. (a) Incision of supracondylar fracture of humerus before operation. (b) Incision of supracondylar fracture of humerus after operation.

reduction and again through the retentive dressing the following day.

The technique described in this work is a simple and safe method. An attempt should be made to avoid the skin incision by sterile towels and dressings, but handling the wound the skin is not touched. I have no reason why the gloved fingers should not be inserted into the wound if the operator is clean and much muscle excitation may be done with blunt dissection by the use of the finger. When the fracture cavity is exposed it is wiped out with sponges and then attention is paid to the fragment. If it is a simple transverse fracture, the bone is reduced and then the other is placed into the wound and the ends are brushed off with sponge. Care is taken not to injure the periosteum or peel it back. After the end has been cleaned the fragment is placed in alignment and the serration can be made to fit each other so that the line of fracture is seen. One succeeding the procedure is to once repressed with the stability of the bone when this anatomical reduction is attained. If there is a tendency to slipping, a notch made with a file will often suffice to hold



Fig. 9. (a) Final result of supracondylar fracture of humerus. (b) Final result of supracondylar fracture of humerus.

properly. When there is a slanting fracture following the above procedure I am apt to use with plain cast. After alignment is obtained the greatest care should be used to maintain the position of the fragment. This requires trained assistants or in severe cases, some form of traction apparatus on which the patient is placed before the operation started and which will allow the application of plaster before removal such as the Ebbel traction apparatus. Since adopting these methods I find myself practically abandoning the use of a bone-plate and the results, not only regard alignment and position, but also regard union and function, justify the extra labor and care required by this technique. It might be well to state here that I remove all bone plates which I have had to use in three months time and hence have avoided all the unpleasant after results sometimes seen. The important point in the treatment of fractures is the return to an anatomical alignment. Such return when not complicated by gross errors is always indicated. Union seems to occur more quickly and there is no noticeable loss of function by this open method.

# THE RÖNTGENOGRAPHIC DIAGNOSIS OF PROSTATIC ENLARGEMENT BY MEANS OF AIR INFLATION OF THE BLADDER

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THE object of this paper is to call attention to a method which we consider of value in the differential diagnosis of prostatic enlargement when cystoscopy cannot be employed. Whenever feasible cystoscopy is to be preferred for by this means we are enabled to obtain information which cannot be afforded by any other method. However it is well known that cystoscopy cannot be performed in many cases in which the hypertrophy is confined mainly to the median lobe. In these instances the outgrowth may be so pronounced, and the urethra so deformed that a profuse hemorrhage is encountered as soon as the instrument strikes the prostatic urethra. Furthermore, cystoscopy may be impossible with a stricture of the urethra, or through a urethra with false passages. It may be inadvisable in debilitated subjects with badly infected bladders, owing to the danger of sepsis.

The method is based on the well known fact that medium of air or other gaseous sub-

stances intensifies the roentgen rays, rendering objects clearly visible which in another medium may be indistinguishable. The technique is simple: a small-sized rubber catheter is introduced into the bladder, the organ emptied, and the inflator apparatus attached. This consists of an ordinary rubber hand bulb to which is attached a glass bulb filled with cotton in order to filter the air. The air pressure can be fairly well gauged by this apparatus. The bladder is inflated slowly and gently until the patient complains of a sense of fullness. It is not advisable to inflate any further for a violent and painful spasm may be produced, expelling both the air and the catheter. The catheter is then withdrawn and the escape of air from the urethra prevented. The plate and X-ray tube should be adjusted before inflation so that the exposure can be made immediately. The patient is placed in the ventrodorsal position. A compression diaphragm of six and one-half inches diameter is lightly applied in such a direction that it



Fig.



Fig.



Fig. 3

brings the focus of the tube about three inches below the symphysis pubis at an angle of eighty degrees with the plate. The radiographs show the prostatic shadow within the bladder very distinctly. That these shadows indeed represented the prostates was proven by operation in three of the cases. After we had carried out the above described method in a number of instances, an examination of the literature revealed a mild method employed some four years



Fig. 4

ago. Burkhardt and Floerchen<sup>1</sup> who carried out these observations made use of oxygen inflations with a rather complicated apparatus. Their results corresponded with ours, but the procedure necessitated a cumbersome outfit with no compensating advantage.

The practical advantages of the method we have employed will be evident from the short histories of the following cases:

**CASE 1.** Bladder with normal prostate. Patient aged thirty showing regularity of bladder outline with no bulging in the prostatic region (Fig. 1).

**CASE 2.** Patient aged seventy, prostatic symptoms of many years duration with four courses of radical cure (Fig. 2). No appreciable enlargement of prostate per rectum. Cystoscopy cannot be performed on account of very small ostium; patient refused resection. Radiograph shows pear shaped bladder with small median lobe enlargement.

**CASE 3.** Patient aged sixty, man with complete retention of urine. Permanent catheter retained on account of difficulty in entering bladder (Fig. 3). Cannot be cystoscoped owing to obstruction in prostatic urethra. Radiograph shows more marked intra-urethral enlargement than in preceding case. Confirmed at operation.

**CASE 4.** Patient aged seventy, prostatic history of few years' duration, moderate enlargement of prostate per rectum (Fig. 4). Radiograph shows distinct intra-urethral bulging of prostate. Confirmed at operation.

**CASE 5.** Patient aged seventy, complete retention of one week's duration (Fig. 5). Large prostate palpable per rectum. When first seen could not be cystoscoped owing to obstruction in prostatic urethra, subsequently cystoscoped with difficulty. Radiograph shows distinctly marked intra-urethral bulging of prostate. Confirmed at



Fig. 5

<sup>1</sup>Burkhardt and Floerchen. Über die Darstellung der Prostata per Oxygenschonflation. *Deutsche Zeitsch.* 1. Jah. 1906.



Fig. 6

operation. Original radiograph distinctly demonstrates enlargement of entire gland.

CASE 6. Patient aged seventy-two, fourteen ounces residual urine, moderate enlargement per rectum, cystoscopy attempted, few times but cannot be performed on account of marked obstruction in prostatic urethra causing profuse hemorrhage; radiograph shows very marked intra-canal enlargement (Fig. 6).

CASE 7. Patient aged sixty-five, prostatic symptoms of six years' duration (Fig. 7). Large prostate palpated



Fig. 7

per rectum. Radiograph above posterior urethra in which can be seen the catheter, and the large prostatic lobes, both project into the bladder.

We desire to express our thanks to Dr. Beer, attending surgeon to the Genito-Urinary Department of Mt. Sinai Hospital, for having placed his material at our disposal.

# WOVEN CATGUT SPLICENTS FOR THE OLDER TREATMENT OF FRACTURES<sup>1</sup>

A PRELIMINARY REPORT

BY DAVID C. STRAU, M.D., C. S. D.

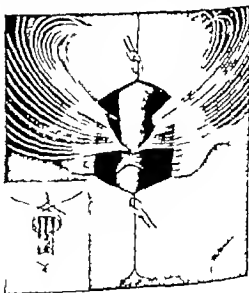
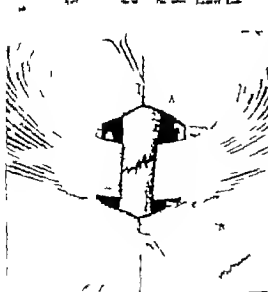
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ALTHOUGH some previous attempt has been made to construct an absorbible splint to hold the fragments of a fracture in accurate apposition, still each has proved itself not enough to render the artificial support no longer necessary. None of these devices has worked out practically, though the metallic magnesium bone pegs have been well with some success. None of the methods now in general use to directly hold the two ends of fractured bone in apposition as usual Metal Bone plates (Laplace-Lambotte) have perhaps proved the most successful means of directly holding the bone fragments together, but these metal plates occasionally have to be removed eventually because of their foreign body action. All of the other foregoing means of direct fixation of the ends also have much to be learned. Therefore, a satisfactory splint of sufficient strength to hold the bone fragments firmly in apposition, of sufficient strength to hold them together until callus formation has taken place, and constructed of material the time of absorption of which could

be regulated rather definitely, could seem to be a welcome every thing in this line of field.

The writer believed that catgut if properly prepared and suitably applied might fulfill these conditions and conceived the idea of weaving heavy catgut suture material in the form of a closely woven mesh and using this as a splint applied at the fractured bone. The idea was thought out and a series of experiments were made. The following method of applying the catgut mesh presented itself and was decided upon. It has the catgut woven in the form of a rug with long fringed ends. The rug is just a bit shorter than the circumference of the bone at the fringed end to be used. The rug about the bone is a splint. These ends when tightly stretched the rug all over the bone holding it firmly in place.

The idea has been carried out in a number of experiments on dogs. The results so far have been in the line of rough raw German catgut No. 4 and No. 5. The raw catgut has been given to us expert oriental rug weavers who have given a hand to the catgut being at the time the process



of weaving to soften it so that it is possible to make a very closely woven rug. The rugs are long enough to encircle the femur of a large dog and are so woven that the length of the rug can easily be reduced to exactly fit any bone of a small or circumference. This is of great practical importance and is accomplished by having the strands that run the long way of the rug (the warp) consist of separate fibers, while the cross fibers of the rug (the woof) are made of one long continuous strand of gut which is alternately woven over and under the long parallel strands. To shorten the rug to fit any given bone it is only necessary to cut one end of this cross-strand free unravel a sufficient amount and then tie the free end again (Fig. 1 C). Thus in human work it would be necessary to have only two sizes of rugs: one for large bones (femur, humerus) and one for small bones (radius, ulna). When the finished rug is dry it is cut from the loom and is ready to be sterilized. So far this has been done by the Bartlett iodine method only. Through the kind courtesy of Dr. A. D. Boyan this has been carried out at the Presbyterian Hospital. In experiments still to be carried out, various other methods of catgut preparation and sterilization will be tried, as well as other absorbable suture material, i. e. chromic catgut, kangaroo tendon etc. to determine which is the most suitable for this purpose.

A glance at the accompanying drawings will explain how the splint is applied. The bone ends are exposed by a free linear incision and the muscles gently separated from the bone, the catgut rug is then introduced around the bone, as shown in Fig. 1, care being taken not to injure or displace the periosteum. If the splint is too long or a little less than just surround the bone when the ends are tightly tied one end of the cross-strand (the woof) is cut free, thus end of the cross-mesh unraveled as shown in Fig. 1 C until the rug is short enough and then the free end is tied again either at a point corresponding to point A or point B. Now the rug is ready to be tied about the bone. Being sure that the line of fracture is at the center of the splint one begins tying the two opposite free ends of each of the longitudinal strands of the rug. In practice it is sometimes

well to tie the first pair at one end and then the first pair at the other end of the splint and so on to finish by tying the strands over the seat of the fracture instead of beginning to tie at one end and continuing toward the other end as shown in the accompanying drawing (Fig. 2). If it seems desirable to re-enforce the splint the free ends after having been tied as described above are long enough to make it possible, after having tied the first series of suture-ends to carry the free ends around the tied splint as shown in Fig. 3 (small figure) and tie each pair of ends again over the original row of knots, so as to thus double the thickness of the splint. However in the animal experiment this has not seemed necessary. When all the strands have been tied and cut, the soft parts are united over the bone with No. 6 plain catgut the fascia and skin each similarly closed, and the limb put up in a plaster cast, which is left in place for three or four weeks.

The results in the ten dogs on which this procedure has been tried have been encouraging enough to make it seem desirable to make a preliminary report of the method at this time. In a later communication, full details of the results and technique will be published. However at this time it may be stated that with the splints as they have so far been used there is some interference with external callus formation, the only apparent external callus being just beyond either end of the splint in the form of a collar of callus. The internal and intermediary callus seem well developed. There have been three cases of non-union. One was due to local infection. The second was a dog that died from an infected struma. The third was in a dog that contracted the mange and was killed because it was so emaciated. In these two latter cases the non-union may have been due to the intercurrent constitutional disturbance. It is too early to draw any definite conclusions except that no trace of the splint is to be seen at the end of three weeks and no inflammatory reaction seems to be produced by the presence or absorption of the splint etc. In a few cases where a sepsis occurred soon after the operation. This cured shortly however and the healing was a *per primum*.



raphy are usually those in which the cystocele is either not large or is absent altogether. As already stated, those cases are in the minority and hence the unsuccessful results so often noted.

It was in an effort to overcome this tendency to bladder prolapse that an operative procedure has been developed which has created a new epoch in the treatment of this condition. The cardinal principle of this operation consists in interposition of the uterus between the bladder and the vagina. While this step represents a new departure in the treatment of procidentia, it had been already employed by Freund and others in the cure of very large vesicovaginal fistulae, the fundus being used to close the fistulous opening. The names of a number of men are associated with the interposition operation for prolapse, more especially those of Watkins, Schauta, Wertheim and Freund. Every operator follows his own technique in the performance of this operation. Although the principle is the same with all, the effect of the procedure is to utilize the uterus as a buttress upon which to rest the bladder. In other words, instead of the uterus being above and behind the bladder as it is normally, the bladder is made to rest upon the uterus, virtually changing places with it. By this interposition of the fundus, the bladder is carried up into the abdominal cavity where it belongs. The hydrostatic pressure of the distended bladder is thus removed from the front of the uterus, where it exaggerates the cystocele to the back where it only blends its action with that of the intra-abdominal pressure to keep the fundus directed downward and forward. The cervix is of course thrown backward and somewhat upward.

The technique of the operation is so well known that I shall not describe it except in so far as report of my own cases may have to deal with a few aspects of the problem which are still unsettled. I have performed this operation in twenty-six cases of complete prolapse in the past five years, and of these I have had the opportunity of re-examining eleven at periods of from a few months to five years. I have heard indirectly from the other cases, the remainder having been lost sight of. With one exception of which I shall speak later, the results have been highly satisfactory, the uterus having retained its new position, and the patient being free from symptoms. A considerable number of patients have complained of some dragging pain, the pelvis for a time after the operation. This is probably due to the pull on the uterine ligaments as a result of the new position of the uterus. Others have complained of some urinary irritability,

obviously due to pressure on the urethra or bladder. Neither of these symptoms has persisted very long in any of my cases. A detailed report of all the cases would be neither interesting nor profitable, and hence I shall merely say a word concerning a few of them which seem individually or in groups to illustrate special points of interest. Of the twenty-six patients in my series, seventeen were beyond the menopause and nine were still in the child-bearing age. Of the latter group all were multiparae. While there is usually no question as to the advisability of the operation in women beyond the child-bearing age, it is necessary in the case of the child-bearing woman to decide each case on its individual merits. In the case of the woman who is very desirous of having children, the Watkins-Schauta operation is at once eliminated from consideration in which case most operators would prefer to perform some form of uterine suspension in combination with a plastic operation on the vagina and perineum. If the cystocele be large, good results are obtained from the modified Watkins-Schauta operation in which interposition of the fundus is not done. On the other hand, in the case of the woman who has had perhaps a number of children and who is suffering with extensive prolapse, the woman's sole desire is to regain her health and comfort regardless of the possibility of future pregnancies. No other operation assures this result as does the Watkins-Schauta operation, and it seems to me to be not only justifiable but clearly indicated in such cases. Under such conditions it must of course be combined with sterilization of the woman, thus being usually easy of performance in the course of the operation. The method I have used in the more cases in which I have carried out this plan has been resection of an inch or more of the tubes, near the cornua, the stump being burned in the broad ligament peritoneum.

It follows from what has been said that the wishes of the patient are entitled to consideration in the surgeon's decision as to the type of operation to be selected. If one of the less radical operative procedures be chosen, the patient should be told of the possibility of recurrence. The two principal facts to bear in mind are on the one hand the desire of the patient to get permanently well and on the other the desire for more children. The degree and character of the prolapse should also be taken into consideration together with such factors as the patient's general condition, her station in life, etc. It will thus be seen that this problem often calls for the exercise of careful surgical judgment.

There are some operators who make a practice of routine amputation of the cervix in all cases. I do not see the logic of this, although I believe that the cervix should be removed whenever very much hypertrophied, as it so frequently is. On the other hand when the cervix, and frequently the entire uterus, is small and atrophic, as it is so apt to be in elderly women, I can see no advantage in its amputation. As a matter of fact it is strongly maintained by Mayo that the cervix should be retained whenever possible, inasmuch as the perineal muscles continually lift it upward, thus throwing the fundus downward and forward, after the manner of action of pessary. Ulceration of the cervix is an indication for its removal. In my twenty-six cases, the cervix has been amputated in twelve.

In two recent cases, not included in the series of twenty-six, though starting out with the intention of performing a Watkins-Schultz operation, I decided to remove the uterus entirely and to follow out the procedure advocated by Goffe. Both of these patients were old women and in both the uterus was very small and atrophic, offering no support to the bladder. In one of them, in addition, the cervix was the seat of extensive ulceration, although malignancy was excluded by microscopic examination of a clipping. At any rate the uterus was removed in both cases, the round and broad ligaments being brought together and the bladder stitched as high as possible on the combined stumps. There has been no recurrence in either case after five and three years respectively. The question of whether or not it is best to remove the uterus as a part of the operative treatment of prolapse is perhaps the one which has been more extensively discussed than any other pertaining to the entire subject. Advocates of both plans of treatment report good results. Theoretically it seems to me that the anti-hysterectomists have the weight of argument on their side and certainly the results of the interposition operation would be difficult to improve upon. By either plan the uterus itself is cared for in one case by removal in the other by its suture beneath the bladder. The matter therefore resolves itself largely into a question as to which operation takes better care of the bladder—which in other words, more certainly prevents recurrence of the ptosis.

A properly performed perineorrhaphy is essential to the success of this operation. The only case in my series in which an unsatisfactory result has been noted is one in which there had been a complete prolapse for fifteen years, recording the patient's history. The interposition

operation was performed in the usual way. On attempting to perform the customary perineorrhaphy however no trace of muscle tissue could be found. The outlet was enormously fully ten by six cm. The levator ani had apparently undergone attenuation and complete atrophy as a result of the long duration of the procidentia. The perineorrhaphy which was performed, therefore brought together only fibrous tissue. In spite of the fact that the anus was narrowed as much as possible, the perineum soon began to yield, and the prolapse recurred, but in a manner different from the original one. The vaginal orifice again becoming very large the uterus now came down bodily as it were, with its long axis at right angles to that of the vagina. It still maintained its position beneath the bladder there being no prolapse of the latter ahead of the uterus. In spite of the drooping of the uterus, the patient was materially improved especially as concerned her urinary symptoms. This case illustrates the importance of a properly performed perineorrhaphy as an auxiliary to the interposition procedure itself.

In a number of other cases, certain minor difficulties were encountered. In one the operation was rendered difficult by the large size of the prolapsed uterus, the operation being performed only seven weeks after parturition. The large boggy fundus was drawn down through the perineal opening with difficulty and the pressure against the bladder and urethra caused inability to void urine for a few days. Involution took place rapidly however and the ultimate result, four years later is excellent. This case illustrates the disadvantage of operating too soon after childbirth. Whenever possible at least ten or twelve weeks should be allowed to intervene before the operation is performed. In another case the bladder was torn during the procedure of separating it from the fundus, even though the glove-covered finger was used for this purpose. The bladder was unusually thin and friable, and in addition was closely adherent to the uterus, probably as a result of a long-standing cystitis. Such a combination of conditions makes it very easy to injure the bladder although the accident is usually of no great practical importance. A few stitches, together with catheterization for a few days, was sufficient, in my case, to prevent any unpleasant after-results. Finally, in two cases, small myomata were removed from the fundus before interposing it beneath the bladder.

To sum up the few points which I have especially tried to emphasize in the report of this series of cases, I would say

1. No other operation for complete prolapse of the uterus offers as great a probability of permanent cure as does the Watkins-Schauta operation.

2. This operation is a decidedly major one requiring more skill than the majority of abdominal operations for pelvic disease.

3. Unless the uterus is very small and atrophic, so that it offers no support to the bladder or un-

less there is a suspicion of malignancy it is better to retain it. When hysterectomy is deemed advisable good results are obtained by performing the operation advocated by Goffe.

4. The cervix should be amputated only when long and hypertrophic, or when it is the seat of ulceration.

5. A well-done perineorrhaphy is an essential for success with the interposition operation.

## HÆMOSTASIS WITH SPECIAL REFERENCE TO ITS EMPLOYMENT IN SURGERY OF THE BRAIN<sup>1</sup>

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THE question of hæmostasis in surgery is one which has received a great deal of attention in medical literature. In ruling various surgical clinics, however, one cannot help being impressed with the fact that at times this most important subject, one of which every surgeon should have complete mastery is given far too little attention. Complete hæmostasis and the careful handling of tissues rank in importance with accurate diagnosis and sound surgical judgment and the tendency on the part of many to sacrifice this phase of surgical technique for the sake of speed in operating is greatly to be deplored and should be universally condemned.

As hæmostasis depends largely on the coagulability of blood, it should not be out of place to review briefly one or two of the most acceptable theories of the coagulation of normal blood.

According to Bordet and Delange (1) coagulation of normal blood consists mainly of three steps:

1. As soon as blood escapes from the circulation it undergoes a change which permits coagulation to take place. This stage is very short and very little is known concerning what chemical or physical phenomena occur at this time.

2. During the second step the active coagulation principle thrombin is formed. The so-called "coagulation time" depends on the duration of this stage. Bordet and Delange think that thrombin is formed by the reaction which takes place between seroryme and cystoryme in the presence of soluble calcium salt. Cystoryme is analogous to the thromboplastin of Howell's theory and is derived from the platelets and leucocytes. Seroryme is contained in blood-

serum but not in blood-plasma. It may be compared to the prothrombin of Howell's theory.

3. During this stage the thrombin acts on the fibrinogen of the blood and causes coagulation by changing fibrinogen into fibrin, calcium not being required during this stage. The time for this step is about two minutes under favorable conditions.

Lee and Vincent (2) report a series of experiments performed along lines worked out by Bordet and Delange, and agree that the fundamental principles of their theory are correct and apply to the coagulation of normal human blood as well as to the blood of rabbits.

According to Howell's theory (3) a small amount of antithrombin is present in the normal plasma and is sufficient to bind the prothrombin and render it inactive. Thromboplastin is set free by cell injury (blood-cells, platelets, tissue cells, etc.) and neutralizes the antithrombin. This frees the prothrombin which at once combines with calcium to form thrombin. The free thrombin coagulates the fibrinogen giving the normal clot.

Whipple (4) in recent paper discusses antithrombin and prothrombin factors in various hæmorrhagic diseases. He accepts Howell's theory of coagulation of normal blood and proves conclusively that hæmorrhagic diseases depend upon the upsetting of the normal antithrombin and prothrombin equilibrium. It is evident that this balance must be extremely delicate and capable of rapid adjustment. When the antithrombin accumulates in excess, the appearance of purpura and bleeding is to be expected but if it drops to a low level spontaneous intravascular thrombosis might occur.

<sup>1</sup>Read before the Alabama State Medical Association, April, 1914.

The ordinary methods of hemostasis are too well understood to permit of discussion. The free use of hemostatic clamps, ligatures, pressure, hot wet packs, etc., will usually suffice in preventing hemorrhage during the surgical operation. The importance of caring for the hemorrhage first in cases of gunshot wounds ruptured extra-uterine pregnancy, etc., has been so thoroughly impressed on the minds of surgeons as to likewise preclude discussion.

The use of isolated tissue as a hemostatic agent is receiving a great deal of attention in medical literature to-day. From experimental and clinical evidence the use of pieces of muscle (fascia, omentum, etc.) in the control of various types of troublesome hemorrhage is a great advance over the older methods.

In surgery of the brain the use of small pieces of muscle in the control of troublesome and dangerous hemorrhage has been practiced for several years. Norrbjeld in a recent article (5) claims to have used muscle for this purpose for the past seven years. In performing subtemporal decompression operations, he controls the hemorrhage from the bone-canal with small pieces of the temporal muscle. This method was first practiced by Sir Victor Horsley, and later by Kocher (6) in controlling bleeding during operations for the removal of the Cerebrum ganglion. Stueda (7) reports a case of cerebellar exploration during which there was an abundant hemorrhage from a large venous sinus, not quite near and communicating with the transverse sinus. Control was accomplished only after he had pressed a piece of muscle over the bleeding point. The patient died of respiratory failure on the following day and at autopsy the small piece of transplanted muscle was found firmly adherent to the vessel over the point where the hemorrhage had occurred. Of interest is the fact that in the central portion of the vein no thrombus had formed. Von Fuchsberg (8) writes also of controlling hemorrhage during the removal of brain tumors by means of small pieces of fascia. Laeven (9) in a similar manner accomplished hemostasis by means of free muscle transplant in heart and liver wounds. Cushing frequently uses muscle in this way and demonstrates the excellence of the method in troublesome hemorrhage from the various sinuses of the brain and meninges. His technique consists in spreading out a small piece of muscle on a moist cotton pledget, placing this over the bleeding point, and after a few minutes of slight pressure removing the cotton pledget, leaving the muscle firmly adherent to the vessel

from which the hemorrhage had occurred. I once saw him stop a sharp hemorrhage from an opening the size of a pinhead in the internal jugular vein with muscle transplant. The method is of value chiefly in hemorrhage from veins and venous sinuses, the pressure in arteries is usually great enough to prevent the muscle from adhering firmly. It would be interesting to learn whether it is the mechanical adhesiveness of muscle or the thromboplastin liberated from the injured muscle cells which is responsible for the perfect result obtained with the method.

The use of isolated tissue seems to be one of the best methods of stopping hemorrhage from wounds of the liver. Barborough (1) has recently published the results of his experiments on dogs, proving the value of isolated pieces of omentum in controlling hemorrhage from the liver and spleen. In the successful experiments the omentum transplant is adherent to the wounded surface of the liver, no blood-clot being found under the transplanted tissue. After the fat in the omentum had been absorbed there remained a thin connective-tissue capsule over the wounded area.

According to some authors, the hemostasis is due to chemical activity through the liberation of thromboplastin; according to others, there is a mechanical closure of the lumen of the vessel. Barborough (1) thinks that the value of omentum as a hemostatic agent is mechanical and not chemical. In several unsuccessful experiments where the omentum was not sutured tight enough the animals died of hemorrhage, which proved to his mind that the chemical activity of the omentum is not great. The mechanical value of the omentum consists in filling the liver wounds tightly with the tissue, thus causing it to act as a tampon or in surface wounds, in laying it tightly over the bleeding surface, holding it there with proper sutures.

In the control of hemorrhage from omentum, parenchymatous organs, such as kidneys, liver and spleen, the older methods consisting of gauze tampons, ligatures, and deep sutures are objectionable on account of the degeneration and necrosis of parenchymatous elements which they produce. Wajsbach and Lebedew (2) produced various wounds in the kidneys, liver and spleen of dogs, and controlled the subsequent hemorrhage with transplanted pieces of superficial fascia held in place with superficial sutures. They also resected parts of organs and sutured layers of fascia over the raw surfaces. In penetrating injuries the wound canal was

tamponed with fascia. After certain periods of time the animals were killed and the specimens examined microscopically. Their conclusions are as follows:

1. The fascia transplanted on the bleeding surface of an organ acts as a "living tampon" which controls active bleeding and prevents subsequent hemorrhage.

2. The free transplantation of fascia simplifies the laying of sutures, and avoids the use of deep sutures which would include and compress tissue and are known to cause a certain amount of necrosis of parenchyma.

3. Fascia is an excellent material to use for this purpose in that it does not act as an irritant to an organ which is in itself capable of developing connective tissue.

4. Fascia acts in a way similar to the normal capsule of an organ and, as the pressure exerted is so slight, no atrophy of the gland is produced.

5. A ruptured kidney treated with this method heals perfectly and functions normally.

6. The substitution of a removed kidney capsule with a sheet of superficial fascia prevent the formation of a secondary scar tissue capsule which would cause a contraction of the whole organ.

There is no branch of surgery in which hemostasis is more necessary or more difficult than in cranial operations. The scalp receives its arterial blood supply through five large trunks on either side. These break up into innumerable branches which anastomose freely with each other. The venous circulation of the scalp is even more complicated than the arterial. On account of the free communication between the veins of the scalp and those of the diploë, bleeding from this source is often more difficult to combat than that which occurs from the arteries and their branches. The meninges likewise contain a network of vessels.

Every cranial operation will be attended by profuse and alarming hemorrhage which will not only annoy the operator but will endanger the life of the patient, unless the surgeon has prepared himself to meet in every detail this inevitable ordeal. Not only must he have experience and judgment, but his armamentarium must include the various hemostatic agents and appliances which have been devised for this special branch of surgery.

The choice and administration of the anesthetic plays an important rôle in cranial operations. A restless, half-anesthetized patient is usually more or less cyanotic—a condition which will cause an almost uncontrollable venous bleeding.

Ether seems to be the anesthetic of choice though Horsley prefers chloroform, and Kocher often uses local anesthesia preferably with Braun's cocaine-adrenalin solution. Nitrous oxide is distinctly contra-indicated on account of the venous congestion which usually occurs during its administration.

A semi-sitting posture of the patient has a definite controlling effect upon the freedom of hemorrhage, and on this account is to be preferred. With the patient in this position, however it is imperative that frequent records of the blood-pressure be made as a sudden fall would necessitate lowering the patient immediately.

Hemorrhage from the scalp can usually be controlled by some form of tourniquet. The type described by Cushing is perhaps the most convenient. Heidenhain (12) recommends subcutaneous interlocked mass ligatures around the proposed incision. Kredel (13) uses a modification of this method by tying the mass ligatures upon a flat metal plate. Horsley finds it efficacious to have assistants make manual pressure while he clamps the numerous bleeding points.

The ordinary oozing from the diploë vessels may usually be controlled with Horsley wax (beeswax seven parts, almond oil one part, salicylic acid one part) though at times these vessels may be so large as to require plugging with wooden or ivory pegs, small pieces of absorbent cotton or pieces of muscle. When the field of operation is near the transverse or longitudinal sinus dangerous hemorrhage from abnormally large emissaries connecting the intracranial veins with those of the scalp may occur and tax the patience and ingenuity of the operator. Cases have been reported where the hemorrhage from the bone assumed such dangerous proportions as to necessitate the temporary ligation of one or both carotid arteries.

In performing cerebellar exploration on patients with marked intracranial pressure one often finds the occipital muscles covered with large lakes of venous blood. To attempt to proceed would lead to an uncontrollable hemorrhage which would probably endanger the patient's life. In such a condition it becomes necessary first to relieve the intracranial pressure by tapping the lateral ventricle through a small trephine opening in the parieto-occipital region. As the cerebrospinal fluid escapes, the venous lakes collapse and one can usually continue the operation without danger from this source.

On opening the dura, hemorrhage from the various branches of the meningeal arteries can

be prevented by means of fine silver wire clips applied with suitably devised forceps, as described by Cushing. These clips may also be used on the middle meningeal artery as it emerges from the foramen spinosum, during operations on the Gasserian ganglion, and on the cortical vessels before incising the brain. The ease of application and their effectiveness make them much more desirable than sutures.

Among the most valuable of all hemostatic agents in cranial operations are small cotton pledgets wrung out of hot salt solution. These are laid on the various oozing points and hasten coagulation. Mention has already been made of the value of pieces of muscle in the control of troublesome bleeding.

Should considerable hemorrhage occur from one of the venous sinuses, it is usually advisable to control it for the quickest way possible and to postpone the further steps of the operation until another time. By exercising this caution in such cases, operative deaths may often be prevented. The justification of a two-stage operation for tumors of the brain lies in the fact that the laying down of a bone flap is usually attended by excessive hemorrhage.

Subsequent hemorrhage in cranial operations may usually be prevented by exercising care in effecting the closures. This is best done by several layers of interrupted fine silk sutures. Such sutures act as ligatures in addition to

aiding the approximation of the edges of the wound.

In conclusion I wish to emphasize the following facts:

- 1 That complete hemostasis is one of the most important phases of surgical technique.
- 2 That the type of operative surgery which sacrifices refinement in technique for the sake of speed should be condemned.
- 3 That the use of various tissues as hemostatic agents has a distinct field of usefulness.
- 4 That hemorrhage during cranial operations is most troublesome and dangerous, and requires for its control the exercise of patience, ingenuity and sound judgment on the part of the operator. In addition to the employment of the various hemostatic agent and appliances known to surgery.

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### A TWO-EYED ANEURISM NEEDLE

By GEORGE T. TYLER, A. M., M. D., GREENVILLE, SOUTH CAROLINA

THE necessity of doubly ligating blood vessels or other tissues, or of placing two ligatures and dividing between them occurs in a great deal of our operative work. In the ordinary aneurism needle threaded with a double ligature one part often becomes twisted around

its fellow requiring extra time to separate and frequently causing annoyance in doing so. It has occurred to me that our aneurism and pedicle needles might be made with two eyes, placed side by side. With each eye threaded two ligatures could be introduced simultaneously and kept separate. This needle can still serve the purpose of the original type by threading only one eye.

The accompanying illustration explains itself.



## MALIGNANT DISEASE OF THE RETAINED TESTICLE

## WITH REPORT OF A CASE

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IN a recent very comprehensive article on this subject Dr. Kenneth Bulkley states that there had never been a collective study of the literature on the subject of malignant tumors of the testicles situated within the abdominal cavity. He was able to collect but 57 cases to these he added two cases coming under his own observation. Dr. Bulkley also states that these tumors occur but once in 60,000 male hospital entries.

With these statements before us it seems well worth while to report all cases.

Dr. Bulkley's paper is so complete and so recent that it seems useless to take up the subject other than to report one case with a very few comments.

Patient was referred by Dr. John T. Hall of Parsons. Age 42, eight 145 pounds he has neither lost nor gained recently. Occupation, farmer. Appetite good, sleeps well. Mother and one maternal aunt died of tuberculous, father of old age. Two deaths from cancer on father's side. Married, no children, claims to have led vigorous sexual life until recently. Has seen that his health is failing during past year. Seeks relief from epigastric with his stomach. Has had an occasional spell for past three or four years three within the past nine months. Nearly all of these cases on during the night, usually they come suddenly and he often vomits before getting relief. After vomiting, is always relieved. Sometimes these attacks of pain last several hours. At first the pain was on right side lately it has been on left.

Previous history negative. About six months ago he discovered an enlargement of the abdomen. Examination showed man of light build, very scanty perspiration, practically no beard and voice rather hoarse on the husky type. Scrotum small, penis rather atrophied, no testicles in scrotum or inguinal canal. Inguinal glands not enlarged. A large mass was found in left lower abdomen, hard, smooth, slightly movable. Patient was told that he had tumor probably malignant, of the left testicle. Consent was asked to remove right testicle no matter what its condition. Operation was performed by Dr. Butt, the Allegheny Heights Hospital on December 30, 1914. Spinal (stovaine) anesthesia supplemented by ether. Incision over left rectus muscle displaced towards median line. The tumor in appearance and location resembled one of an ovarian growth. Surface smooth, glistening, covered with peritoneum. Pedicle about two inches broad, attached in region of left internal ring. Very slight attachment to bladder and bowel. Tumor weighed three and one half pounds, free test circumference 10 1/4 inches, lesser 14 1/4. Right testicle was removed from deep in pelvis. No measurements are taken but it was perhaps 5 per cent larger than normal. Convalescence was delayed by right otitis media. This occurred on the twelfth day, drum was incised and ear had almost ceased to discharge when he left hospital. On the sixteenth

day after operation he began to suffer with pain in the calf of his left leg. No pain, no swelling, until he was up walking. Left hospital on the thirty second day, well with the exception of phlebitis of left leg. One month after then he wrote that he was not feeling well, legs swollen, unable to work. A month later he presented himself for examination. With exception of condition noted in left leg he seemed in excellent health. Had gained ten pounds. June 8th, he wrote me that his general health was not so well, weights six pounds more than when operated, has some pain in back is doing light work is unable to get his bowels regulated.

Diagnosis. Notwithstanding the rarity of this disease there should be little trouble in making diagnosis if the absence of one or both testicles is noted. It seems from the literature on the subject that many men have failed to note this. This is due in some measure to the natural desire of the patient to conceal his deformity. This was the case with our patient. He had to be practically forced to discover his scrotum.

Prognosis. According to Bulkley of 59 cases operated on only three are known to be alive and well after two years.

Treatment. Excision of the retained testicle upon the onset of even the vaguest symptoms.

Microscopic examination (Dr. Arkin.) Scattered throughout the tumor section are masses of large cells, with pale vacuolar nuclei, some of which show distinct nucleoli and a clear cytoplasm. Many of these cells are irregularly arranged in solid masses forming nests or alveoli which anastomose with each other giving to the tumor the appearance of a scirrhous type. In other areas these large cells are arranged in more or less distinct tubule formations. In still other areas, the carcinoma cells have infiltrated between the connective tissue fibers, forming long cords or chains of cells. Mitotic figures can be distinguished in some of these cells.

The interstitial tissue is rich in darkly staining small round cells and numerous spindle cells of a connective tissue type between which the large round or polyhedral cancer cells are scattered. In a few places there are aggregations of lymphoid cells resembling very closely normal lymphoid tissue. In one or two areas, the dark small round cells are arranged about small blood vessels presenting the appearance of a peritheliomatous proliferation.

Scattered through the section are found round or oval pale hyaline-like areas, some of which are solid, others presenting small lumina. A few of

these lumina are filled with calcareous deposits. These areas, in all probability represent atrophied seminiferous tubules which have undergone a fibrous. In the connective tissue can be seen, here and there typical giant-cells of the Langhans type, containing from six to twenty nuclei. The nuclei in these cells are arranged about the periphery although in some the nuclei fill most of the cell, depending upon the direction in which the cell was cut. In some portions of the tumor these cells are more numerous than in others, and they are found in the connective tissue.

The tumor is surrounded by a definite capsule of connective tissue, which is irregularly infiltrated with many dark round cells of a sarcomatous type together with a few large round or polyhedral cells with pale nuclei. The small round cells form solid cords two or three cells in thickness, or else chains of two to six or eight cells lying between the connective-tissue fibers. The carcinoma cells form anastomosing bands which lie between the small round cells. These are arranged parallel to the surface and seem to have infiltrated the loose connective tissue between the capsule and the tumor forming a distinct zone between the two. They are especially marked about some of the blood-vessels, and seem to have followed the course of the lymphatics.

The tumor shows very little evidence of necrosis, as the cells in the central portion stain quite distinctly. There is no bone tissue, cartilage, muscle, or cyst formation in any portion of the tumor.

The section sent as right testicle presents no normal testicular tissue. Scattered throughout the section are many round or oval areas which stain faintly and have a hyaline appearance. They contain a few elongated connective-tissue nuclei. These are evidently remnants of the seminiferous tubules. No normal seminiferous tubules are visible in any portion of the section. The fibrous tubules are much more widely separated than in the normal testicle. The great part of the section consists of diffuse masses of large round or polyhedral cells which contain large pale nuclei with fine chromatin granules. These cells resemble the ones described in the tumor sections. The cancer-cells have a tendency to alveolar arrangement. Between these cells are many proliferating connective tissue cells and numerous dark small round cells. The cancer cells stain more deeply about the larger vessels, and it is here also that the small round cells are most numerous. There are in this section just

as were described in the tumor section, several lymphoid accumulations. Likewise, a few giant-cells, resembling those described in the tumor, are present in the connective tissue. The capsule is infiltrated with many small round cells, and connective tissue cells in various stages of development.

The section sent as left testicle shows the cancer-cells quite numerous, with a greater tendency to alveolar arrangement. Some of these alveoli are entirely surrounded by connective tissue, most of them anastomose with one another. There are several large solid masses of these cancer-cells in the section which have the appearance of a medullary carcinoma. These masses show no evidence of necrosis, and seem to be growing rapidly. They are surrounded by an indistinct connective-tissue stroma, through which masses of cells are penetrating in every direction. The connective-tissue stroma contains many small round cells. There are several large lymphoid accumulations in this section also. Just beneath the capsule, which is not greatly thickened, are numerous darkly stained small round cells. A few giant-cells can be found in this section also.

There is no normal tissue in the section sent as epididymis. The vas cannot be found in the section. There are a few irregularly shaped compressed tubules, lined with low columnar epithelium, in one corner of the section. These are the only evidence of tubules in the epididymis. Near these can be seen several compressed canals of the rete testis. The tissue is entirely infiltrated with solid masses of cancer-cells, separated by proliferating connective tissue which contains many small round cells and quite a few giant-cells of the Langhans type. The section also contains several lymphoid areas. In most respects it resembles the tumor section described above.

The tumor represents a case of sarcomatousness of double undescended testicles. The sarcomatous portion predominates, and the connective tissue shows evidence of sarcomatous proliferation with large numbers of small round cells. In addition, there are also giant cells present, making the tumor an unusual one. There are lymphoid follicles present in the tumor an observation which has been made in many mixed tumors of the testicle. The mixed tumor has involved both of the undescended testicles and the adjacent tissues.

(A complete pathological study of this case will be published later.)

## SURGICAL HELPS

By G. P. COOPERNAIL, M. D. BROOKLYN, NEW YORK

**A** PRACTICAL CAUTERY. For several years I have been using the cautery that I am about to describe. The cautery irons that I wish to advocate are the small size soldering irons. They can be found in any of the large department stores. The end of the irons can be shaped as you wish with a coarse file.

The heating apparatus is the gas blow torch used by plumbers or painters for burning off old paint. They are furnished with soldering iron attachments. The fuel used in the torch is the commercial gasoline. Operating the torch is very simple. Connected with the torch is a small air-pump which gives a forced feed. A few strokes of the pump will give you a pressure that will last for a half hour heating.

Under the burner is a priming cup which is filled with gasoline. This heats the burner so as to convert the gasoline into a gas. I use alcohol in the priming cup, as there is an odor to the burning gasoline. After the cup is burnt dry open the needle valve and light the gas.

The size of the flame can be regulated by the needle valve. This gives a very hot flame and will heat the irons in a very few minutes. It will heat much quicker than the Bunsen gas-burner and can be carried and used in places where there is no gas. It is light and can be easily carried in your bag. Another good feature is, you can always rely upon it.

The impulse to write this brief article came to me a few months ago when I saw a celebrated English surgeon demonstrating one of his intestinal operations. That morning to be sure of having one of the Laquelin cauteries in good working order the operating room nurse tried out three of them and found at the time all would work but at operation none would work.

*Paper clips as spools for linen or silk sutures.* For over ten years I have been using the ordinary paper clips in place of the glass spool for linen or silk sutures.

They are cheap and more convenient than the glass spools. There is no danger of their breaking, so they can be boiled with the instrument.

Another advantage is the ends of the sutures can be caught in the center of the clips so it will not unwind when not in use. After operating I dry

them out in a drying oven with the instruments. The last few years the tendency is to make most of our surgical instruments with screw locks, so it is almost impossible to get them dry in the lock. A few minutes in a hot air oven will dry them and prevent rusting.

*Patches for repairing rubber gloves and how to put them on.* For the past ten years I have been having my nurses use small round patches for mending rubber gloves.

Before I used the round patches one day I noticed our operating room nurse trying to cut out patches with a pair of scissors. The rubber was not easy to cut and after the patches were cut out they had many sharp corners to work loose. One could see a round patch would be much better.

The idea came to me to punch them out with a gun-wad punch. The punches are made in several sizes.

The patches can be punched out of the gauntlet of an old glove. With a hammer and a block of hard wood one can in a few minutes punch out enough patches to last a long time. They make an ideal patch without corners.

Clean the patch and glove with gasoline. Stick the patch on a piece of cardboard with two pins near the edge of the patch. This will prevent the patch from curling up when the cement is drying. Let the cement almost dry before pressing the patch over the hole.

It is better to give both the patch and the glove two coats of cement, letting the first dry before applying the second. After the patch is firmly pressed on dust with talcum powder so as to prevent the cement outside of the patch from sticking.

A test tube is great help in patching the fingers of the gloves. Don't forget to put the patches on the inside of the gloves. I remember when doing a strangulated hernia at night that patch came off and was left in the wound. It healed by primary union but the fifth week one end of the incision broke down and in exploring the wound I found a rubber patch in the bottom of it. This would not have happened if the patch had been on the inside of the glove. I am glad to say it was not one of my round patches.

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

THE REGULAR MONTHLY MEETING OF THE CHICAGO GYNECOLOGICAL SOCIETY WAS HELD APRIL 17 1914 WITH THE PRESIDENT OF THE SOCIETY DR FRANK W LYNCH OCCUPYING THE CHAIR

DR MARK GOLDSTEIN presented a paper under the heading of Report of Cases

### REPORTS OF THREE CASES OF ABNORMAL DEVELOPMENT OF FEMALE GENERATIVE ORGANS

CASE. Mrs. Rose R. 33 years old Menstruation began at 14 years 25-day type duration 4 to 5 days. Flow very heavy and with severe pain. Last menstruation March 7, 9. December 27, 9 gave birth to 8½ pound baby which was her first pregnancy. On December 31st she had severe chill with rise of temperature and severe pain in lower abdomen and was very ill for number of days. When I saw her first on January 24, 9 she presented typical picture of puerperal sepsis. There were large tender masses on left side of abdomen, from the pelvic brim to about the level of the anterior superior spine and one inch to the left of the median line apparently no exudate. The right iliofemoral and iliohypogastric were the same on physical examination. She was admitted to the Wesley Memorial Hospital January 29, 1909 and remained in the hospital 41 days until March 3, 9. On leaving the hospital there still remained considerable mass on left side.

After recovery after admission to hospital Abdominal examination same as above. Vaginal examination slight laceration of perineum, just inside vulva there presented itself very firm septum, dividing the vagina into two equal compartments. It was about ½ inch thick at vulva and about ¼ inch at its posterior attachment. It was of same structure as vagina so opening in septum between its vaginal ends vagina contained cervix, one normal in appearance and the other showing the effects of recent childbirth. A probe was passed into each and on right side went in about three and one-half inches, and on left about four and one-half inches. Patient was readmitted to hospital May 9, 9. The mass on left side only little smaller. In abdominal section was done on the left side was fairly large retro-ovarian abscess the uterus, tube and ovary were removed the blood supply was entirely from left side. Space of three inches separated above uterus from another on the right. The uterus with its tube and ovary on the right side received its blood supply entirely from the right side. No apparent connection between the two uteri. The bladder and ureters were normal in size and position, structures normal and in position. Patient is now ill and has menstruated regularly since operation, very little pain and menstruation not nearly so profuse. As far as the writer can ascertain this is the only case recorded in literature where there were two distinct uteri.

CASE. Mrs. W. age 30 married 8 years 2 children 20 miscarriages. Last baby born 6 months

Menstruation began at 5. Regular 25-day type and was exceptionally profuse and lasted 8 to 9 days. Menstruated regularly every month during her pregnancies but not as heavy as usual, and also during lactation. Recoveries from childbirths uneventful. Had no attacks of appendicitis. Severe backache for years. Abdominal examination negative except for tenderness over appendix and lower abdomen. Vaginal examination complete laceration of perineum. Cervix large, external os normal. Finger made laceration. Perineal examination same on left side about the size of normal uterus and tube on right. No space of about 4 inches, directly in midline here no structures could be palpated. Here left examining hands could easily be brought together. In abdominal section was performed and showed in place normal in size and appearance and about 5 inches apart, each with normal tube and ovary on the left and right sides respectively. No evidence of blood supply or appendages on the outer sides of the two uteri, both lay to the extreme sides of the pelvis and are retroflexed. A large heavy fold of peritoneum in the form of a band ligament about two inches wide connected the bladder with the sigmoid and upper part of rectum and lay between the two uteri. The bladder was very large. The external os was open and just inside the cervix the canal divided into two divisions, one canal going to each uterus.

CASE 3. Miss Blanche H. age 3. Finely history negative. Ordinary features of childhood. Has had severe headaches for last 4 or 5 years. Has never menstruated. Nothing like menstrual cycle in patient history. Anamnesis. Vaginal examination. Uteri and clitoris poorly developed. Normal ureters. Imperforated hymen. Rectal examination no evidence of uterus or vaginal vault, no cervix to be felt.

Gynopexy perineum very broad like male pelvis and easily reached from rectum. Manual examination with finger in rectum no uterus could be felt and no definite pelvic structures felt.

Exploratory laparotomy. On right side cystic artery about size of hen's egg with normal tube and accessory tube attached about ½ inch from the fundus and with a fertilized egg of 20 days, this tube was 2 inches in length and just slightly smaller in its circumference than the tube it is attached to. The same tube terminated in small embryological structures resembling uterus this was about ¼ inch long ¼ inch wide and the same in thickness, this terminates in the vaginal portion posterior to the bladder. Broad ligament normal. On left side was found the same as on right, but only one tube and normal ovary and same structure resembling uterus. No connection between two sides. No cervix either uterine or vaginal and bladder and rectum usually normal. This case is very unique.

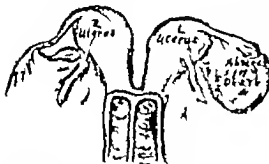
Dr. WALTER C. JONES followed with a paper entitled "Experimental Ligation of One Ureter with Application of Results to Clinical Gynecology—Inguinal Thesis."

Dr. A. BRICHAM KEYES read a paper entitled "Mastitis Lactantis: Etiology, Behavior and Treatment." (See p. 364.)

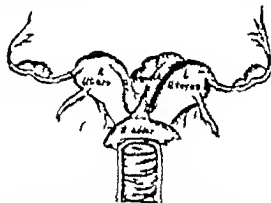
#### DISCUSSION

Dr. N. S. HEARNEY: I was very much interested in Dr. Keyes' paper because it referred to a subject to which I pay a great deal of attention. It has been a matter of luck, rather than careful attention, I believe, that I have had very few abscesses—in fact only two, and those were unfortunate enough to have been doctors' wives. The obstetrician as a rule assumes no responsi-

see another case, and yet within the last few months I have had two, and one of them is unique, as far as the cases I have seen are concerned. In that on the ninth day the patient suffered a great deal of pain in the left breast, a mass formed, filling up practically at least a quarter of the right side of the breast, with some redness of the skin, high temperature and chills. The temperature was  $105^{\circ}$  when I saw her, but there was no fluctuation. The usual treatment was pursued—absolute rest, ice pack and later hot fomentations. This was continued forty-eight hours. The temperature would go up every afternoon very high with chills. Finally it was decided the best thing to do was to open



Double uterus. One ovary and one tube to each uterus. Two cervices separated by partition.



Bicornate uterus. One ovary and tube to each horn. Bladder attached to sigmoid by reflection of peritoneum.

bility for the occurrence of breast-abscess, in which he is most properly justified, except in this, that he is responsible if the nurses who are attending his patients are not properly instructed in the attention to the breasts. One thing that has always appeared to me as especially dangerous is the handling of the breast by the hand of the nurse who at one moment takes up a vulvar pad and puts it on a chair or window when she goes to answer the bell of another patient, and the next minute brings in the child to the breast and gets the nipple to work, so the child can grasp it. If the nurse's hand becomes contaminated with the secretion of the pad, she is absolutely dangerous to the breast of the mother.

Dr. PARSONS: I do not know that I can add anything to this interesting paper. Abscesses of the breast, I think, are becoming rare. As we become more proficient in the handling of our obstetrical cases, we who are especially giving more attention to these cases see very few cases in our own practice. I thought I would never

the abscess. I made a good free opening, making an opening large enough to pass my finger in and get the pus. I inserted my finger and found it to be a hard mass, not broken down. No culture was taken to determine just what the mass was, but there was no discharge. The tube was taken out in about 48 hours. There was nothing except the secretion you get with any wound of that sort, with the temperature and pulse normal. It went along this way hours. Suddenly there was another pain, another rise of temperature and chills in the other breast—the same identical picture. I waited, hoping perhaps I might be mistaken. It might have been that lump that caused the trouble. I waited 24 to 48 hours more, no fluctuation. I opened that other lump and did the same operation. The temperature dropped in 24 hours, normal and remained normal, and the wound took place without any discharge. The question is, when to know that we have some abscess for operation. Unless you have the distinct

fluctuation it is sometimes difficult to say just when to open or whether you have a difficult abscess to combat or not. I don't know in this case whether resolution would have gone on without opening. On the other hand, I do not believe we find as many cases as we did and I think the whole treatment is in the prophylaxis, the treatment before and during the first few days of the puerperium.

Dr KAYES (closing the discussion)

I feel that we do a great deal of good by making a free incision and drainage in a large number of cases. We let out a lot of serous

material and the temperature drops to normal. The indication is to let out that material and yet there is no telling whether it has ever gone resolution. The fact that there was a hydro-eruptate there is almost as much cause for it being emptied as if it were pus. The infection undoubtedly may cause a very marked amount of disturbance, and the marked frequency of the pus is the greatest perhaps in the lymphatic infection. I firmly believe in cases of deep hardness that the indication is for early and free incision, and as Dr Paddock correctly stated, I believe there should be deep drainage.

## CORRESPONDENCE

Dr Franklin H. Martin,  
Chicago

My dear Doctor: In *SURGERY GYNECOLOGY AND OBSTETRICS*, for June 1914, Department of Technique Dr O. H. Stanley of Concord N. H. writes his experiences with pituitrin in abdominal surgery and is anxious to know of the experiences of others. Having a little data, I am pleased to submit the following results:

I have used pituitrin as a routine post-operative treatment in seventy-five laparotomies, namely: gall stones, obstruction of the bowel due to adhesions, post-operative adhesions, appendicitis, hysterectomies, ovarian cysts, ectopic pregnancies, pyosalpinx, and others with the most gratifying result. Pituitrin has a stimulating effect on the heart muscle and the bladder as well as its stimulation of peristalsis. Because of its satisfactory action on the heart I have discontinued the use of strychnine and digitalin as I found that the pituitrin gave the same effects.

My method of administration is to give 1 cc. per hypo as soon as the patient comes off the table. This is repeated at intervals of four hours—often if necessary, though I have not

had occasion to do so, except in a case of fecal impaction, which I did not operate. In this case I gave 1 cc. every 15 hours, aided by high colonic flushings, and obtained gratifying results.

I have not had to catheterize more than two cases, and these were cases of malignancy with involvement of the bladder. Following cholecystectomy I have had good results, and I am inclined to think that it has prevented that most serious complication, namely, acute dilatation of the stomach, so much dreaded following these operations.

In none of the above cases did peristalsis of the bowels occur.

From this experience alone I have come to the conclusion that pituitrin is a great adjunct to abdominal surgery. Given in reasonable doses following laparotomy it is all that is necessary in the way of medical treatment, as it not only stimulates the functions of the heart, bladder and intestines, but tends to prevent the many complications due to adhesions and peritonitis following an abdominal operation.

Yours fraternally  
LYMAN H. M. GRIFFITHS, M. D.

# BOOK REVIEWS

## A CRITIQUE OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

BY GEORGE GELLHORN M D SAINT LOUIS MISSOURI

THIS textbook has grown out of the author's *Diagnosis of Diseases of Women* which was the first and for a time the only American work of gynecological diagnosis. The good features which distinguished this book reappear in the large volume before us. The author recognizes the principle that the correct interpretation of symptoms rests primarily upon thorough knowledge of the morbid anatomy and he therefore pays particular attention to a detailed description of both the macroscopic and microscopic structure of the affected parts.

The general practitioner will welcome the chapters on conservative methods of treatment such as douches, baths, massage, diet and tampons for these non-operative measures have not received the due share of consideration in textbooks and in practice which they rightly deserve. In these days when gynecology is in danger of becoming merely a surgical specialty the gynecologist too should make himself conversant with every non-operative measure which may promise relief. For this reason, pessaries might have been given a little more space than the author reserves for them. For prolapse of the uterus when operation is deemed advisable the author recommends the old cup and stem pessary attached to an abdominal support. The reviewer would venture the opinion that the Mergle and Loebstein pessaries have rendered the McIntosh pessary obsolete.

On the matter on hygiene, dress, and exercise the author shows himself in line with the best teachings of the day. This chapter short as it is will be of greatest value to the practitioner in that it will enable him to forestall disease by his wise counsel.

The chapter on post operative complications and their treatment will doubtless be consulted with advantage by many and help in numerous instances to turn the scale in favor of the patient.

Thus or few cannot be closed without word of appreciation of the chapter on diseases of the urinary system. This field is no longer on the borderline between gynecology and surgery. The genital and urinary systems in the female are so closely allied both topographically and developmentally that familiarity with this topic has become an absolute necessity to the modern gynecologist.

May we not ask the author to eliminate biblical references in future editions of this book? If for example he believes that pregnancy may occur after the menopause (p. 68) he should be able to cite more recent cases than that of Abraham who was one hundred years of age and Sarah ninety when their child was born.

In a work of this size debatable points are bound to occur. One can, for instance, hardly agree with the author when he dismisses in less than four lines the subject of spinal anesthesia notwithstanding the fact that this method has become the sovereign one in gynecological operations in Germany and France and is just now having a renaissance in this country. But such points of difference are really of little value in weighing the value of the entire book which has been written in so concise a manner and which so clearly portrays the author's qualifications as an excellent teacher that we do not hesitate to warmly recommend this textbook to the profession.

WE greet an old friend in this new edition of a work which in the highest degree of modern text books has preserved the old-fashioned popularity. The rapid changes which are taking place in gynecology have imposed upon the author the duty to rewrite many chapters but by rigid rearrangement and condensation he has found space for much new matter without enlarging the volume. The simplicity and clearness of diction renders the study of the book both easy and attractive to the reader and as the book addresses itself primarily to the student mooted questions have been left out of consideration. For the same reason bibliographic references have been restricted.

To the specialist the volume possesses particular attraction in the profusion of original illustrations, many of high order in color. The reviewer gladly acknowledges his indebtedness for many points of operative technique and he believes that others too will frequently find it helpful to consult this book for details of simplification and elegance. In the development of American gynecology Dr. Dudley ranks foremost as master of plastic methods of all kinds. His operation for pathologic retraction of the uterus, the reconstruction of a urethra, his procedure for retrovaginal fistula and the operation for certain

forms of urinary occurrence form only a partial list of the author's original contributions which are incorporated in this textbook. It is safe to predict that the seventh edition of this work will be but a question of time.

THIS book has a number of features which are apt to make it attractive to teachers in urban training schools. The descriptions are for the most part, clear and precise and there is appended to each chapter a discussion on the function of the respective organs. In this manner the author has in a very fictitious fashion, combined the study of anatomy and physiology of the human body—the best method, indeed, in which these two subjects should be treated. There is also at the end of each chapter a list of questions as a means of reviewing the subject.

ANATOMY AND PHYSIOLOGY.—A TEXTBOOK FOR NURSES. By John Farquhar Little, M.D. The Human Textbook Series. Philadelphia and New York: Lea & Febiger, 1914.

The book has, however, in common with most textbooks on anatomy for nurses, the defect that it is much too long. A subject which the average medical student with all his required preparatory studies is expected to cover within a year or two, the nurses, most of whom possess but an indifferently preliminary education, are supposed to imbibe in about eight months. The value to a nurse of instruction about barytosis of *Ascaris megalocephala* is at least, open to discussion, and pericolic, transitional, and neuro-epithelial cells will I fear prove merely a burden to her memory which might contain more useful information.

Concerning the discussion of the female genitalia and their functions might still be more extensive for in this field the nurse needs more knowledge for her own benefit and that of her clients.

Print and paper are very good, but the illustrations are not in keeping with the excellency of American medical illustrations, which have set an example to the rest of the world.

## BOOKS RECEIVED

Books received are acknowledged in this department, and each acknowledgment must be regarded as sufficient return for the courtesy of the reader. Selections will be made for review on the interests of our readers and spare periods.

DIAGNOSIS OF FETTER OCULI. Vol. I with Index, Vols. II and III with illustrations. By Edward L. Outman, M.D. Troy New York: The Southworth Company. \$4.

PRACTICE OF SURGERY. B. Russell Howard. Price \$5.50. Philadelphia: J. B. Lippincott Company.

THE SEA TALKS TO BOY. B. F. D. Steinhardt, M.D. Philadelphia and London: J. B. Lippincott Company. \$0.40.

ANATOMY AND PHYSIOLOGY OF THE FEMALE URINARY ORGANS. By John Webb Crowley, M.D. Published by the author.

PHYSIOLOGIE NORMALE ET PATHOLOGIQUE DES REINS. By L. Anblard, M.D. Paris: F. Gauthier Editeur.

LA STÉRILITÉ FÉMININE. Par le Docteur E. Borel. Paris: G. Masson Editeur. \$4.

PRACTICAL THERAPEUTICS. Second Edition. By Daniel M. Hoyt, M.D. Price \$5.00. St. Louis: C. V. Mosby Company.

SIZE. AMERICAN MEDICAL BOY. By B. Howard A.

Little, M.D. LL.D. Troy New York: The Southworth Company. \$14.

REVIEW STUDIES OF TUBERCULOSIS. St. Louis: International Medical Journal Company. \$14.

MEDICAL AND SURGICAL REPORTS OF THE EMPEROR HOSPITAL OF PHILADELPHIA. Philadelphia: Wm. J. DeWitt, 1914.

NOTIONS PRATIQUES D'ÉLECTROTHÉRAPIE. Ouvrage à l'usage des Médecins. Par le Docteur Dreyer. (traduit de l'allemand). F. Gauthier Editeur. \$14.

RECHERCHES SUR L'ALIMENTATION CHIMIQUE (NUTRITION). Tubingen Germany: H. Laupp'schen 1914.

COLLECTED PAPERS BY THE SURGEON OF ST. MARY HOSPITAL, MAYO CLINIC. (1914). Rochester: University of Minnesota Press.

PHILADELPHIA AND LONDON: W. B. Saunders Company 1914.

KLINISCHES HANDBUCH DER GYNEKOLOGIE. VON DR. MED. DR. GYNEKOLOGIE UND GEBURTSHILFE ITS HILF. PRAKTIKALISCHES ARZT. By Dr. W. Leppmann. Band II.

Phäsiologische Anatomie und Histologie der Weiblichen Genitalorgane in Kautzsch'scher Darstellung. By Oskar Frankl. Leipzig Germany: J. C. W. Vogel 1914.

LAURENCE DES HERNIES. FIFTH EDITION, enlarged and revised. By Bernhard Siegmund. \$4.25.

Leipzig: Wilhelm Engelmann, 1914.

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## INTERNAL DERANGEMENTS OF THE KNEE

B. ROBERT JONES F.R.C.S.I. (Hon.) F.R.C.S.E. CH. M. LIVERPOOL, ENGL. AND  
Lecturer on Orthopaedic Surgery Liverpool University

I HAVE chosen the subject of derangement of the knee joint because comparatively so little has been written about it in your own country and this has always been a matter of great surprise to me for your games like our own are rough, and we in England know to our cost that your youth are very skilled and very strenuous. I am credibly informed that the anatomy of their knee-joints differs but little from our own and I am forced to conclude either that their cartilages are more securely placed than ours or which is most unlikely that the condition is not so generally recognized as it should be. When I mention to you that I have explored the knee joint in search of mechanical derangement on no considerable or on a thousand occasions and that surgeons all over England are adding their large experience to our literature it seems perhaps appropriate that I should endeavor to place before you some practical point which may be helpful both in making clear the diagnosis and in simplifying the treatment.

By far the most common derangement of the knee is injury to the internal semilunar cartilage. In my experience this occurs eight times as often as injury to the external meniscus. The internal artilage is more firmly fixed and is not allowed the give and take movement of the external and

in addition it bears a greater strain during the normal movements of the joint, often becoming thinned and frayed along its inner margin. In the normal relation of femur to tibia the line of force is carried through the inner side of the knee while the abducted position of the foot when exaggerated produces outward rotation of the leg. A further reason for the disproportion may be the shape of the internal articular surface of the tibia which allows the internal condyle of the femur to glide backwards on the tibia thus the range of internal rotation of the femur on the tibia, which is a direct strain on the semilunar is greater than that of external rotation. In view of the fact that displacement of the internal semilunar will at times give rise to symptoms on the outer side of the joint it is well to remember how rarely the external cartilage is displaced.

We must also remember that in nearly all cases the cartilage is displaced inwards, and in those rare cases where a protrusion has been felt from the outside it is due to hemorrhage following a tear or a localized bruising of tissue or a buckling of cartilage accompanied by effusion which gives rise to an irregular outline of the articular margin. When we consider the shape of the discs an outward displacement would be most unlikely to give rise to locking of the joint.

The most constant symptom of a displaced



Fig.

or fractured semilunar is a sudden inability to extend the knee. This very generally comes on immediately after injury and less frequently it does not. I have seen many cases where no history of locking could be obtained as occurring at the time of accident, but it has occurred at varying periods later. This may sometimes only appear so because of the difficulty an injured patient has in analyzing his symptoms. Avoiding this fallacy we may be assured that in an appreciable number of cases the locking is for the first time complained of long after the initial injury. This fact is important from a legal aspect. The most frequent cause of the displacement or fracture is strain thrown on the internal lateral ligament while the knee is flexed and the tibia rotated outward. In rare instances I have known a displacement occur while the knee fully extended. The force necessary to cause the derangement in a first injury is usually severe and the pain is acute. The injury may often be noted on the football field. The athlete drops and rolls on the ground nursing the knee. Assisted he hobbles off the ground with his knee flexed. When he arrives home the joint is painful and distended. If the articular is still displaced it reduction gives considerable relief from pain. The tender point of pressure

are over the internal lateral ligament and over the anterior horn of the internal semilunar. Any attempt to abduct the limb at the knee is acutely painful. Forced extension of the knee is painful over the site of displacement. I maintain that if an injured semilunar is rationally treated after its initial displacement it stands a good chance of being completely cured—a much better chance than it does at any later period. If the reduction be immediate and efficient and the limb be kept fully extended there is every reason to hope for good union. The first displacement is not often accompanied by any degenerative change. Reduction however must be absolute. All movements of the cartilage must be prevented until union of the torn structures is complete and no lateral strain must be allowed until the lateral ligament so often injured has had time to effect a recovery. There are many ways of reducing a cartilage, but if an anesthetic be not used I have always thought it wise to summon the assistance of the patient himself. I first fully flex his knee and rotate it inwards. I then tell him at the count of three to forcibly extend his own knee while we help him by pressure from without. In this way he materially assists the surgeon and simplifies the reduction. In this manner I often reduce displacements of several weeks duration. The reduction can usually be felt. If the reduction is complete, the patient usually knows definitely and at once and the surgeon, if wise, will abide by the expression. If the patient tells you the cartilage is still out he is generally right and it is best to believe him. In all recent displacement after reduction the knee should remain fully extended. If the knee does not remain completely extended the displacement is not corrected. Such a joint with a clear history of semilunar injury and strained or ruptured internal lateral ligament should be treated by complete rest for four or five weeks. Instead of this the patient is usually allowed to get up and walk in a week or a fortnight. This is a mistake and the outcome of an indifferent surgery and in a majority of instances is the foundation for a series of recurrences. The cartilage can only be

retained in a fixed position when the limb is fully extended. In all rotary and lateral movements of the joint the cartilages participate. Rest of the limb in the fully extended position is therefore indicated and as long as the effusion lasts the patient should be recumbent. Prolonged effusion relaxes by elongation all the protective structures of the joint; we should therefore aspirate should absorption be retarded. Elongation of the quadriceps with subsequent weak knee is closely associated with prolonged and recurrent effusions. Massage can be practiced while the knee is being rested and still more valuable is to encourage the patient to practice contracting his quadriceps without flexing the joint. I am sorry to dwell so long upon the treatment of the initial lesion but it is perhaps the most important point I have to make and perhaps the most neglected. Unfortunately many of us become obsessed with the alleged advantages of a hurried convalescence and the illusory fears of adhesions. They are only snares for the unwary. A little common sense should help us to realize that the best way to promote the healing of torn structures is not to put them on continual or even occasional strain. These arguments obviously do not avail us when dealing with recurring displacements. When the patient is up we should guard his internal lateral ligament from strain during walking. He should be directed to walk with his toe slightly turned in and his foot inserted. This is made easy by raising the heel of his boot on the inner side to deviate body weight from the inner to the outer lateral ligament just as we would do in an early case of knock knee (Fig. 1).

It is more common to see the case when the acute symptoms are over and when several recurrences have taken place. We have to depend then upon the history which is usually definite enough. First, whether of an injury it may be seen or, in slight cases usually referred to about the time of the foot flexion and external rotation of the tibia. Locking of the knee may have occurred on the first occasion or not—very rarely a treacherous always. Even when locking has not occurred a giving way or slipping is referred to. The story of a

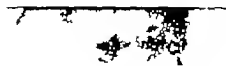


Fig.

reduction makes the diagnosis complete. If the knee be examined a few weeks after the accident the effusion will have gone but there is often pain on pressure over the internal lateral ligament and above the tibial margin over the anterior horn of the semilunar. On slight hyperextension of the knee pain is often felt in front of the joint. At a still later stage recurrences and fresh effusions may have occurred accompanied by locking of the joint the pain on each occasion being capable of definite localization. Locking is the most definite and reliable symptom and unless it occurs an element of doubt must always remain. One frequently finds a fractured or displaced semilunar where there has been no clear history of locking but the discovery is made if not with surprise with a distinct sense of relief. The patient will often only be prepared to admit to a something yielding on the inner side of the knee which gave him

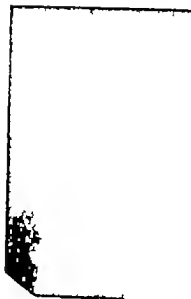


Fig. 3

a sense of insecurity. This may involve only a momentary inconvenience or it may occasionally be accompanied by synovitis. On other occasions the patient states that he feels something slip in and out, merely giving him a sense of insecurity. The one constant fact should remain, namely, that the patient is always definitely clear that the sensation does not change from place to place. The various displacements are often said to be accompanied by a click.



Fig. 4



Fig. 5

There is no time to deal with the exceptional case which makes the surgery of the knee joint so fascinating. It is often impossible to diagnose and can only be investigated by operation. Amongst such I have found the external cartilage on the inner side of the knee and I have found the fractured end of an internal cartilage lying on the outer side just internal to the external lateral ligament. I have found cartilages so split up that different segments of the same cartilage would be displaced at separate times giving rise to distinctive symptoms. Frequently I have found two separate lesions either of which would account for the symptoms, and unless both were rectified the operation might have failed. Sometimes fringes and lipomata and pedunculated semidetached bodies (Fig. 5) have been present when I have expected a displaced cartilage, and I have sometimes even had to close my wound without having remedied any defect. These confusions show you that the knee is sometimes as secretive as the abdomen.

Although these surprises take place the diagnosis of a displaced meniscus is comparatively a simple matter. It is liable to be confused with certain pathological conditions



Fig 6



Fig 7

of which the most common are synovial fringes, loose bodies, lipomata and extra-articular osteomata.

In synovial fringes the symptoms are less acute in their primary onset. The pain is quite local and is not participated in by the internal lateral ligament. Creaking in the joint is common and effusion almost invariably follows each snapping. There is usually in the recurrent case a thickening on either side of the ligament of the patella due to hypertrophy of the postpatellar pad. In cases of recurrent synovitis of the knee with thickened postpatellar pad accompanied by occasional twinges in front of the joint synovial fringes may be expected attached to a postpatellar pad (Fig 3).

Loose bodies lock the knee sometimes but usually only for a brief moment. The symptoms are sharp but not acute. They can always be differentiated because unless pedunculated they can be isolated in different parts of the joint although they usually have a favorite resting place. They can generally be demonstrated by radiograph (Fig 4). I have known lipomata to lock the knee but

the symptom they produce are rarely acute. They are often accompanied by painless effusions and can often be felt in the pouches.

A careful examination will usually reveal an osteoma. It can be felt and radiographed. It is the means of locking a joint when a muscle or tendon slips over them. The locking is never accompanied by effusion.

There is a type of knee which clicks on full extension and wherever you place your finger the clicking seems there. This is sometimes due to a nodular condition of the anterior portion of the semilunar but often it will be found associated with a slipping in and out of the external cartilage very clearly to be felt by placing the finger between the bones.

I hold decided views on the subject of operation. In the first place I refuse to operate upon any case whom I see at once the victim of a first displacement as so large a proportion of cases get well under appropriate treatment. I do not encourage operation in cases where the recurrent trouble is painless and

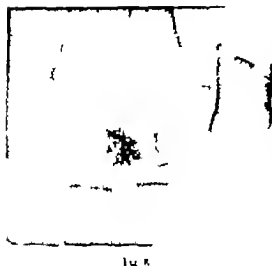


FIG. 4.

ne followed by effusion in the joint. I would operate where the recurrent effusion is sometimes followed by acute symptoms and I encourage it in all recurrent cases where a strenuous athletic life is a matter of livelihood or a physical necessity. Operation is a positive necessity in the case of men who work or stand in positions where a swelling knee may mean disaster. Age is not necessarily a contra-indication. I have operated upon a girl of thirteen and a man of sixty.

An argument in favor of operation is the occurrence of tubercle and so called rheumatoid trouble, a direct result of the irritation of a displaced cartilage. I have published several such instances.

If I decide to operate I prefer to do so with the knee flexed to right angles so that it need not be further flexed during the operation. The most convenient way is to have the limb hanging over the end of the operating table (Fig. 5). Some thicknesses of gauze squeezed out of a solution of bichlorid of mercury is wrapped round the joint and the incision is made through the gauze the cut edges of which are fixed into the wound. In this position it is not necessary excepting in stout people to make the incision longer than an inch and a half. The incision I now employ is nearly transverse commencing just behind the ligament of the patella

ing slightly above the tibial border. Through this small opening a most excellent view can be obtained of the joint. The interior of the joint is then inspected with the aid of retractors. The finger should never enter the joint. Neither the surgeon nor the assistant should be allowed to touch the wound except with sterile instruments. The sutures for the capsule should be handled on forceps the edges of the capsule being secured by a blanket stitch. The cartilage may be found in almost any conceivable position. It may be split along its inner margin. It may be fractured. It may be detached anteriorly. It may be turned inward like a bucket handle with its convexity inward. It may be neither the posterior part may be in front the anterior portion may be loose and nodular. It may be attached at its extremities and free along the whole or part of its outer border. It may be firmly fixed with its inner border frayed and serrated. The anterior part may be ground away or found quite loose as a separate body. It may look quite normal but its moorings will be found loose, or the posterior part may be split which can only be discovered by detaching the anterior portion and drawing the cartilage into the middle of



FIG. 5.

the joint. The examination should be gentle and it is made easier by the use of a small blunt hook. It is only necessary to remove the loose portion of cartilage if the remainder be firmly attached. If it be decided not to remove the whole cartilage care should be taken to make the section without drawing upon the stump otherwise it will be loosened and give rise to symptoms of recurrence. The capsule should not be closed until a search has been made for fringes, tabs, or other possible sources of derangement. I always apply a tourniquet and never tie a vessel nor drain the wound. Effusion. If it occurs is usually very trivial if the operation has been done gently. As no structures of any importance to the stability of the joint have been severed, walking may commence in ten to fourteen days, the joint being protected for another week.

Loose bodies of whatever type should be removed. An endeavor should first be made to localize and fix them. This should be done immediately before the anæsthetic when the patient's help may have to be insisted. His hands should be sterilized and he should wear



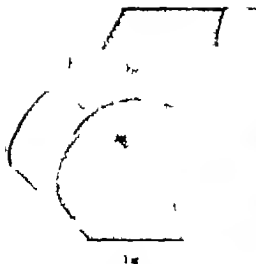
Fig.

a mask and rubber gloves and the fixed body should be placed in the keeping of a reliable assistant. The knee should be kept extended during the operation.

These loose bodies are often found in connection with rheumatoid arthritis and should be removed whenever practicable (Fig. 6). This may involve splitting the patella longitudinally to obtain a good view of the interior of the joint (Fig. 7). Loose bodies are frequently found at the back of the joint and obstruct flexion and sometimes extension (Fig. 8). These cannot be effectively removed by an anterior incision and it will be necessary to approach the joint from behind. By reason of the narrow communication between the anterior and posterior portions of the joint they are not prone to travel if they should prove of any size. Their removal is not difficult. An incision is made through



Fig.



the popliteal space the nerve and vessel being kept to the outer side and usually the loose bodies can be felt through the capsule. This route has also been described by my friends Brackett and Osgood.

I have many times operated upon joints that became locked and obstructed by the slipping of muscles or tendons over exostoses around the knee. The slide shows such a case (Fig 9). The patient a good athlete was frequently pulled up when running with a pun at the back of his joint which I ascribed to an external semilunar. The knee on occasion locked. An X-ray revealed a pedunculated exostosis which obstructed the vastus. When removed it was found to be surrounded by a bursa containing fibrous masses.

This slide (Fig 10) will serve as a type of several such cases upon whom I have operated. The patient usually gives the history of a knee which slips at the back. This takes place only during unusual or active exercise. The knee sometimes completely locks and is often very difficult to reduce. Generally the symptoms are not severe, merely a sense of discomfort and slight slipping. The patient falls, gets up again, and feels the back of his knee and then goes on with his game. Sometimes it is the biceps which is hampered at other times the inner hamstrings, and in one instance I removed a pedunculated



exostosis which often became entangled with the inner head of the gastrocnemius. Here you see an osteoma (Fig 11) which ceased to trouble as soon as it fractured. Later then it occasionally obstructed the cartilage. The next plate shows a flattened osteoma which gave rise to symptoms suggestive of an injured semilunar really due to its contact with the articular and semitendinosus and the osteoma shown in the next slide (Fig 12) caused a slipping of the knee on many occasions until it was removed. More rarely derangements may arise from sharp exostoses over the adductor tubercle, as shown on the slide (Fig 13).

The diagnosis of such cases is easily made. They can be felt by the finger and demonstrated by the X-ray.



Fig. 4



Fig. 5



Fig. 6

These cases are only a few of a large number which prove the part osteomata may take in disarranging the mechanism of the knee. Osteomata are so often found causing no symptoms that their evil conduct may some times easily be overlooked.

There are two conditions to which I would make a brief reference, as they give rise to very considerable disability. I allude to rupture of the crucial ligament and fractures of the tibial spines. The diagnosis of ruptured crucials is simple if we remember their functions.

The anterior crucial ligament is tense when the knee is fully extended and prevents the tibia from being displaced forward on the femur.

The posterior crucial ligament is tense in complete flexion and prevents the tibia from being displaced backwards on the femur.

Both ligaments check inward rotation of the tibia. Hence if after an injury of the knee the tibia can be displaced backwards or forwards or rotated inwards in the extended position, an injury of one or both crucial ligaments may be assumed.

If in the extended position the tibia cannot be displaced forward it may be assumed that the anterior crucial ligament is not torn.

If in full flexion the tibia cannot be dis-

placed backwards the posterior crucial ligament is not ruptured.

The diagnosis, therefore of ruptured crucials is not difficult if we exclude those cases of abnormal mobility due to elongation or destruction of the ligaments associated with long continued effusion into the joint or with changes associated with Charcot's disease. A large experience of dislocations gives me the authority to state that if injuries resulting in ruptured crucials be treated by rest to the joint for several weeks an excellent recovery will usually result. It is therefore unwise to attempt their restoration by operative means.

Fractures of the tibial spines, of which I have seen many cases may or may not be associated with rupture of the crucials (Figs. 4, 5 and 6). The most constant sign of this fracture is an obstruction to full extension. The block feels like a definite bony obstruction and is quite different from the locking which occurs when a dislocated semilunar or a synovial fringe is nipped. If this block should not be present the case should be treated by rest and fixation. If there be a block, then with the leg hanging over the table the patella should be split longitudinally and the post patellar pad removed together with the fractured spine.

Mr. President and Gentlemen: I feel I have placed the subject of my argument of the knee before you in condensed and hurried fashion. The lesions are probably much more common with you than your

literature suggest. If by good fortune the clinical suggestions I have offered you hold promise of practical use I shall feel more than ever grateful for the privilege of addressing you.

## OPERATIVE TREATMENT OF ANKALOSIS OF THE MANDIBLE

WITH A HISTORY OF THE OPERATION AND AN ANALYSIS OF TWO HUNDRED AND TWENTY CASES

BY A. P. BLAIR, M.D., D.D.S.

MY object in presenting the subject of ankylous maxillomandibular limitation of movement of the lower jaw is to emphasize the fact that this is by no means an unexplored field and that abundant work has been done and a sufficient number of cases have been reported to tabulate and analyze the treatment of the two groups of cases of this kind. Both our review of the literature and observation make up our own experience have shown that practically all of these are relieved and that when properly operated the relief is permanent, rest is given to the mouth and a functional lower jaw. The analysis is of that group of cases of these cases present themselves and the length of time the ankylous has existed would alone be sufficient reason for liberal presentation of the subject.

In the present time I will take up the important analysis of the cases in the general literature stating our own experience and when they are pertinent.

### AGE OF THE PATIENT AND THE DURATION OF THE DISEASE

In the report of the cases at which the patient was first treated in the first two months to fifteen years. A little over 25 per cent of these patients were ten years of age, which puts the remainder over twenty years and are between thirty and fifty years of age. Our youngest operated case was twelve years old at the time we did double resection of the condyles. The latest was about sixty years when he came for treatment.

### EXACTING CAUSE AND AGE AT WHICH IT OCCURRED

The age at which this took place varied considerably but in the great majority of cases where the age was given it was under ten years. In one case injury at birth was the supposed cause. By far the most common cause was trauma this accounting for nearly fifty per cent of all cases. The great majority of these injuries were not given a wound and by far the most common form of injury was a blow or fall on the chin. L. W. Orlow found that in one hundred and four cases which he analyzed only twenty-nine per cent were relieved by treatment but this does not correspond to the findings in a review of the report of cases.

Next to injury comes scarification usually with suppuration in or about the joint which accounted for about one-fifth of all cases.

Next in frequency is suppuration in or about the joint without outside the specific cause not being stated. In a few cases the suppurative focus started about a tooth. Among the other factors in diseases typical was the most prominent factor but pneumonia, measles, scarlet fever, diphtheria, syphilis, ulceration of the tongue, glandular disturbance or meningitis in different cases.

In one of our cases the exciting cause was in all probability a gonorrheal arthritis. The child had a gonorrheal ophthalmia at the same time as the arthritis. Rheumatism and rheumatoid arthritis are put forward as a cause while worms and mercurial stom-



Fig. 1 A normal condyle in the glenoid fossa.

this account for a few cases. We have seen several cases with multiple joint lesions that would come under the heading of hypertrophic arthritis or rheumatoid arthritis.

#### CHARACTER OF THE ANKYLOSIS AND ITS CLINICAL DEVELOPMENT

In the cases drawn from the literature bony ankylosis would be inferred as the cause in the great majority of the cases. Next in frequency are fibrous bands in the joint while cicatricial bands in the cheek come next. In one case a scar band attached to the coronoid process is given as the cause while in another a tumor was attached to the zygoma.

Among our cases two were solid bony ankylosis on one side and in these cases the coronoid process and condyle were represented by a solid bony mass fused to the base of the skull with no sigmoid notch and no glenoid fossa. In four of them there was a short close fibrous ankylosis of the joint with considerable change about the condyle and coronoid. In most of the cases the sigmoid notch was entirely absent the ramus being continued up in its full width ending in a broad flat rough base that was closely attached to a similar flat surface at the site of the glenoid fossa. In two there was apparently less bony change in the joint. In one case there was considerable limitation due possibly to the dislocation of the inter-



Fig. 2 A normal condyle rising on the articular eminence, mouth partially open.

articulation of the interarticular fibrocartilage. It came on suddenly while an injection was being made for a facial neuralgia and continued without change. In one case the ankylosis was apparently due to a very large strong styloid process that impinged the posterior border of one ramus of a receding jaw. Cicatricial bands in the cheek limited the opening in three cases.

The development of the ankylosis has in all of our cases, been gradual. There was the injury or the arthritis and later it was noticed that the amount of opening was limited. Gradually this decreased until there was complete or almost complete closure. The case of supposed dislocation of the cartilage cited above was an exception to this rule. In all attempts had been made to force the mouth open, and while these may have been for a time partially successful, their result was only temporary. There seems to be a strong tendency for what at first must have been a simple fibrous ankylosis to turn into a complete or almost complete bony ankylosis. Where the ankylosis

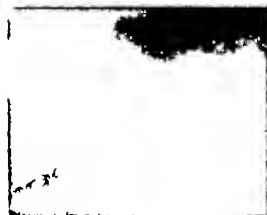


Fig. 3. Close-up view of the tongue in the same position as in Fig. 1. The tongue is in the same position.



Fig. 4. Close-up view of the tongue in the same position as in Fig. 1. The tongue is in the same position.

was due to changes in the joint that occurred during the growing period. There was a lack of development of the lower jaw with a resulting hindrance to the normal development of the upper jaw. The cause is not clear. If it were due to the fact that the traction of the myofascial system of the mouth is greater than the lack of development in the lower jaw, the child should be able to open the mouth. Another possibility is that it suggests itself that a normal strain of the myofascial system in the mouth may have influenced the development of the jaw.

**Symptoms.** The chief symptom is the inability to open the mouth fully. The mouth may be limited to opening of the mouth may be completely closed. In the latter case the mouth is filled with a mass of tartar material on the buccal surface of the upper and lower molars continuously. If there is a somewhat loose union of the myofascial system of the mouth, the child is able to open the mouth to a certain extent. The reason for this is that while the attempt is made to open the mouth the myofascial system of the mouth is able to pull forward on the myofascial system of the mouth on the myofascial system of the mouth. This is very distinct and before the day when the X-ray was adequate for

showing the condition of the joint, we were able to see the definite lack of development of the lower jaw. The treatment of the child is early and should be referred to. The general health is usually impaired.

**Treatment.** The simplest form of treatment and one that has been reported to be probably all cases is the surgical division of the myofascial system. It may be done gradually with dilator or with a single incision. The division may be done fully under an anesthetic. In one reported case it was administered as a single number of times. However, the review of the literature and our own observations lead us to conclude that simple division is for one reason or another rarely satisfactory. It can do no good in both cases, and unless it is performed in for an indefinite period it will be of no permanent advantage in the child's case. Fibrous ankylosis or when there are dense scars in the joint. In simple light joint adhesions division may be all that is needed.

In considering the operative treatment must distinguish between cases when the joint is fixed directly and those in which the limitation is due to scars in the joint that bind the upper to the lower jaw. In the latter case the operation is designed to relieve



Fig. 5. Profile and dentures of child five years old who had double fibro-osseous ankylosis existing for 1 year, showing the retraction of the mandible. Reconstruction of both jaws 1½ years ago and though there is fair amount of opening, there seems to be little development of the mandible.



Fig. 6. Plaster reproductions of the dentures showing the relation of the jaws in case of dense fibrous ankylosis during the growing period and the amount of correction of the mandibular retraction that was accomplished at the time of the operation for ankylosis.

both conditions. For cheek scars which are usually confined to the mucous surface probably the first method attempted was the simple division or excision of the bands but this is not efficacious for the bands soon unite again or new scar forms at the site from which they were excised.

Lamarch in 1855 before the Congress at Göttingen proposed his operation, which consists of the excision of a wedge shaped piece of bone three quarters of an inch long from the body of the jaw in front of the banding scars. This gives a good functional result but is not the best means at our disposal.

In 1862 Clendon of the Westminster Hospital of London devised a pair of silver shields that fitted over the molar teeth and had flanges which extended down into the reestablished bucco alveolar sulcus. These were used to protect the teeth while wedges were being inserted and the flanges seemed to prevent the scar bands from becoming directly reattached to the jaw.

Dr. Ewing Mears of Philadelphia divided scar bands by surrounding them with ligature which was tightened each third day. By this means and with dilatation he got an opening of three quarters of an inch.

Brophy has inserted a ring through the tissues surrounding the scar band as has been recommended for pharyngeal adhesions, later cutting the band at the site of the ring after the ring has become epithelialized.

It would seem most reasonable to excise the scar bands and replace them with soft epithelial tissue. This has been done with strips of mucosa obtained from within the mouth, but these strips may not be easily obtainable. A plan which we have used repeatedly where the mucous lining of the mouth was deficient and applied with a satisfactory result after the excision of limiting scar bands, is the transplantation of a skin flap from the neck attached by a pedicle and brought into the mouth through an incision in the lower fornix of the cheek. The flap is sutured in place and ten days or two weeks later the pedicle is cut and the defect in the upper part of the neck repaired. (Detailed description of this method is given in Blair's *Surgery & Diseases of the Mouth*.) The skin, which must not be hair bearing, adapts itself kindly to the new situation, and it seems the most reasonable and satisfactory method of dealing with extensive intra oral scar bands.

Busch reports a case in which Korte repaired the defect left after excision of scar bands by means of flaps obtained from within the mouth. Murphy has reported a similar case. It would seem probable however that this method is applicable only to those cases in which the bands were confined to the posterior part of the cheek.

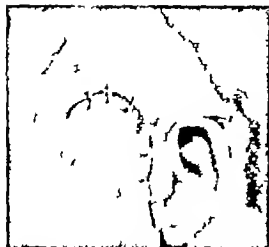


Fig. 7. The author's method of removing the ramus of the mandible. The incision is shown below the ear and the resulting fracture line is indicated. The ramus is shown being removed.

For ankylosis by this is using the point that will not yield to simple dilatation (and) it will dilate to permanent. It is still in view of the point or the removal of a section from the body of the ramus will be necessary (spontaneous) and it will be around the point of ankylosis with it out and but the ankylosis returns.

The method of operation which is the reason for a fair sized piece of the full thickness of the bone at or in front of the angle was one of the first to attract general attention and is still popular. For further historical data see text and history of the end of the jaw.

The more rational one but one more difficult of execution has been described by Bottini and consists in the removal of the condyle or the condyle and removal of the ramus when both are involved in the disease but a mass of bone uniting the ramus to the base of the skull.

George Murray Humphreys in 1864 raised the condyle for the removal of the ramus that was just reaching the jaw.

Excision from or section through any part of the ramus is likely to be made but unless a considerable piece of bone is

removed or unless some material is interposed between the cut end these may reunite. Various materials have been used for interposition between the bones—metal gutta percha, rubber plate, neighbor's muscle tissue or foreign animal membrane. We have also used a flap of the subcutaneous temporal fascia and believe it admirably adapted to the purpose. The method of approach has varied somewhat but is equally near the angle or on the lower part of the ramus the incision is usually made along the lower border of the jaw and the posterior part of the ramus. For approaching the neighborhood of the joint numerous different incisions have been used. The chief essential of the incision is that it renders the joint accessible and that it does not destroy the nerve supply to the fibularis palmaris. In the operation we employ we have had it very valuable to preserve the nerve supply of the anterior belly of the occipital muscle.

In general the incisions that have been employed are given by J. W. Orin as

1. Vertical incision first used by Bozies
2. Horizontal
3. Bistoury arched incision with convexity forward and downward
4. Alexander tongue-shaped incision over the masseter muscle
5. Incision one part vertical in front of the ear the other parallel to the zygomatic

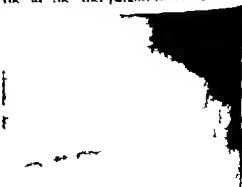


Fig. 8. Showing the result of excision of an early lesion of the ramus. The upper part shows the ramus in situ, and the lower part shows the result of excision, with the ramus removed and the joint exposed.

- 6 Humphrey's upper angle incision
- 7 Abbe's lower angle incision
- 8 Hirsch's and Cabot's cross incision
- 9 Kraske's combined arched and horizontal incision

Years divided the ramus above the last molar from within the mouth and twisted out the upper fragment. The incision which we have employed in all of our cases differs somewhat radically from those presented elsewhere and has the advantage that it is almost completely within the hair line and allows of the making of a properly fashioned flap of fat tissue for the construction of the new joint. The skin flap with a very little subcutaneous tissue is turned downward and forward. Then a similar flap is made of the subcutaneous tissue down to the temporal fascia; this latter should contain the trunks of the temporal artery and can be uninjured. The parotid gland containing the branches of the seventh nerve and the masseter muscle are stripped downward en masse with an elevator; the site of the joint and the upper part of the ramus are exposed; the condyle, coronoid and upper part of the ramus are removed with burrs, biting forceps, and chisel until there is a space of three quarters of an inch between the ramus and the skull. Next the fat flap still attached at its base is sutured to the now exposed internal pterygoid muscle so that it rests between the cut portions of bone. The skin flap is sutured in place and a rubber dam drain is let out through the lower part of the wound. After cutting the bone the mouth is forced open with a specially constructed dilator. If the mouth will not yield sufficiently then the operation must be repeated on the other side. We have had but one case of double ankylosis although in one case a patient thirty-five years of age who had had a complete unilateral ankylosis for fifteen years the good joint was very stiff and required careful stretching with considerable force. In another case while attempting simple dilatation we fractured the jaw at the site of an unerupted third molar and after the fracture united, excised the ankylosed joint. Though it causes discomfort we prefer to dress the mouth open for a week.



Fig. 9. Shows the condition resulting from ankylosis during the growing period and the result of the operation with transplantation of cartilage into the joint. She has permanent opening of one inch 4 years later.

This operation which we presented at the St. Louis Medical Society in 1910 we have employed in five cases, and the results are such that we have no inclination to modify it in any essential detail, except where there is excessive recession of the chin. In the latter case the operation as described above is done on the ankylosed side and on the other a simple subcutaneous section of the ramus is done with a Gigli saw. Then the body of the jaw is drawn forcefully forward and held in this new position by wiring the lower to the upper teeth. These wires remain in place twelve weeks. Later gradual stretching of the new joint is done with rubber wedges or bottle stoppers. In two cases we have rounded out a deficient mental eminence by implanting a section of costal cartilage in the soft tissues of the chin.

**Results.** The immediate result where the mouth was dressed open was an opening of three-quarters to one inch. By the use of a rubber bottle stopper this opening is preserved or even increased in the next two months. Later the opening gradually increases until it may reach one and one-half inches. In a child of five years, with a double ankylosis we were unable to get more than three-quarters of an inch opening and a rubber dilator had to be used a long time to maintain this, but I believe in time this amount of opening will increase. In